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VICTORIA · · · AUSTRALIA

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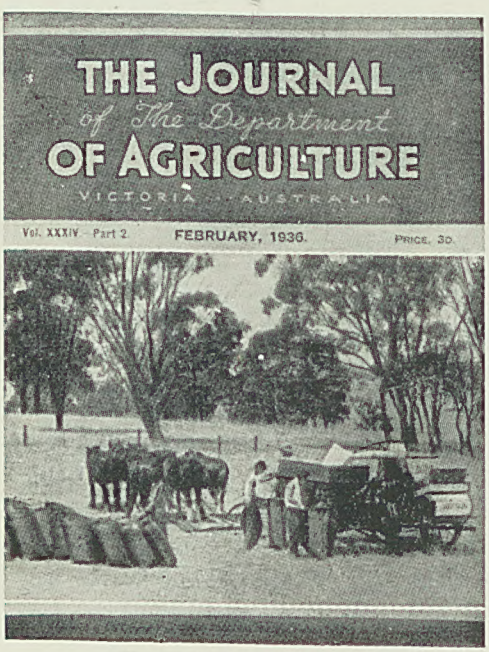

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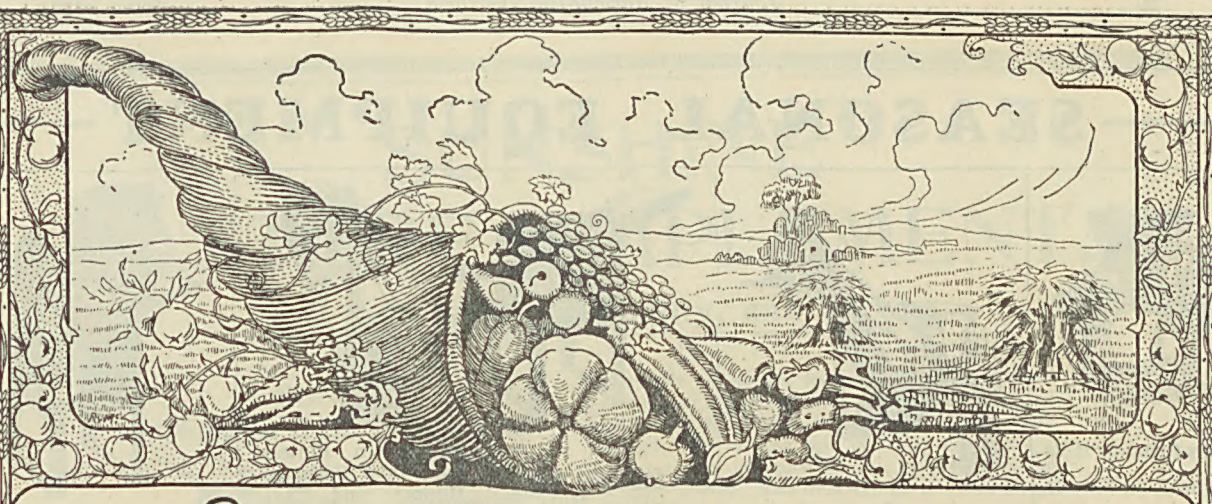

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Issued under the direction of the Hon. E. J. Hogan, M.L.A., Minister of Agriculture.

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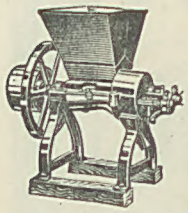

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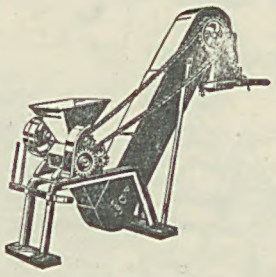

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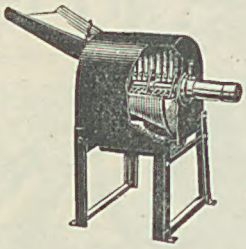

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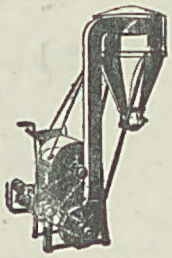

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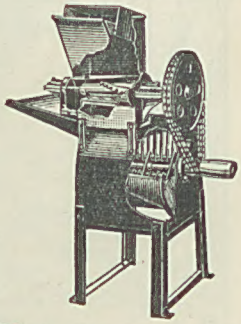

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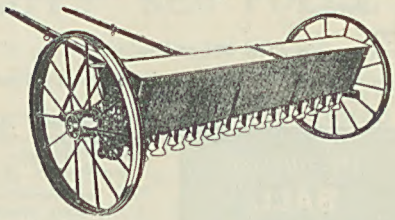

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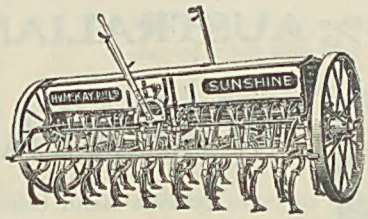

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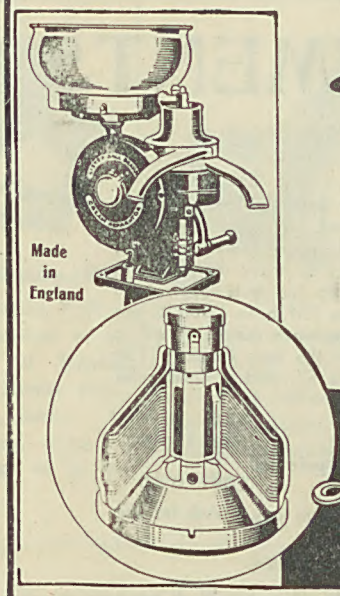

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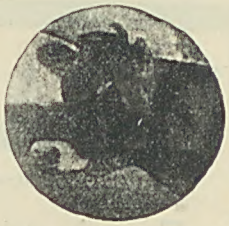

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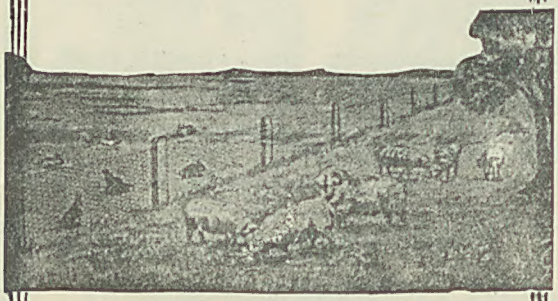

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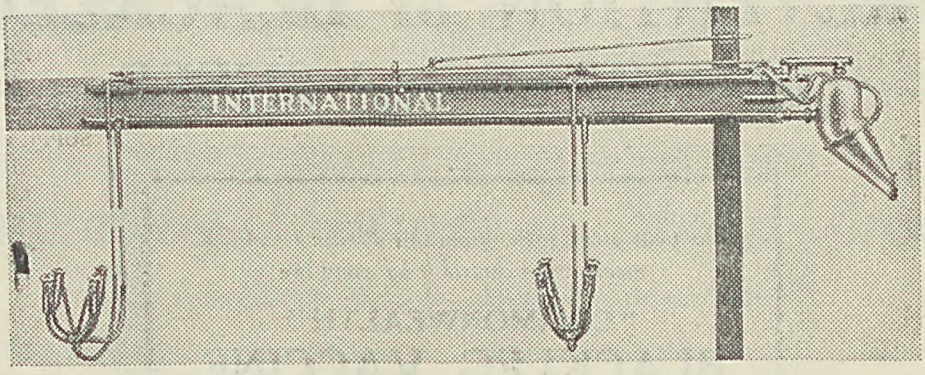

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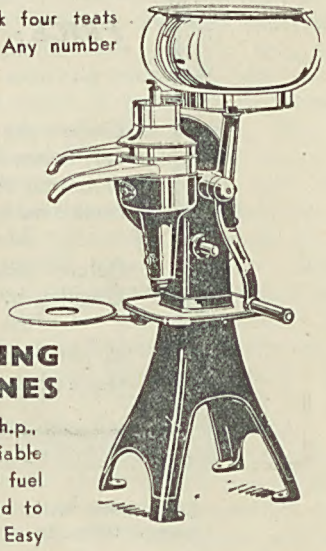

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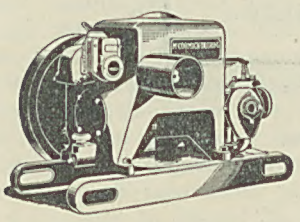

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The Journal of the DEPARTMENT of AGRICULTURE of VICTORIA

Improving Pastures in Sheep Areas

By J. E. Harrison, B.Agr.Sc., Agrostological Research Officer

SUBTERRANEAN clover is outstanding as the plant which is increasing the carrying capacity of our sheep pastures to-day. During the past ten years the average number of sheep in Victoria has increased from 12 millions to 17 millions, an increase of 40 per cent., which must be attributed largely to the growing of subterranean clover, and to the top-dressing of clover fields with superphosphate. Subterranean clover has been accepted as a plant of primary importance in pasture improvement, and a lengthy discussion on its value is not necessary. When we come to consider the best grasses to grow in combination with it, and the means by which they may be preserved, we encounter problems more open to discussion, and a brief review of them will be helpful.

The various grasses which we may consider are perennial rye grass, Wimmera rye grass, Phalaris tuberosa, the native grasses like Danthonia, and introduced annuals such as barley grass and silver grass. Since these annual types are regarded as undesirable because of their early death in the spring, and the objectionable seed heads which they leave behind them, we may dispose of them and restrict our consideration to the others.

In a broad way the problem appears to resolve itself into a question whether we should endeavour to preserve the native grasses in our pastures, or replace them with introduced plants. Though there is a tendency to discard the native grasses in practice, it is being done somewhat reluctantly by many growers who have a considered appreciation of their value. Though low producers, the native grasses are highly persistent, and have a carrying capacity of from one-half to one sheep per acre. They make a small response only to superphosphate, and when clovers are introduced and stimulated with top-dressing, the native grasses tend to disappear from a sward and give way to annual types. As they give a green picking after summer rains and come away more quickly than annuals after autumn rains, their disappearance is a loss to the pasture.

Though the case is not very strong for these native plants, it is as well to consider by contrast what success is being obtained with introduced species. Perennial rye grass is very useful in those areas receiving round 23 inches or more of rain a year, where it persists sufficiently well to warrant its regular establishment. The risk is a long dry summer (like the last one) which will take a fairly heavy toll of the plants and leave bare ground for the intrusion of undesirable annuals and weeds. Nevertheless, perennial rye grass is the most useful grass to sow down with subterranean clover where the rainfall is reasonably favorable, and is always worth inclusion, especially on land which has been used for cropping and is being seeded down to pasture. No other species will give as rapid growth as perennial rye grass after the first autumn rains.

Wimmera rye grass and Phalaris tuberosa are persistent under the relatively low rainfall of our pastoral areas, and may be successfully cultivated. Wimmera rye grass is easily grown and is a very productive annual, its seed heads also being palatable and nutritious during the summer months. If it is to be maintained in any importance in a pasture, however, some sort of surface cultivation is required every second or third autumn, and its maintenance entails more expense and trouble than that of a persistent perennial; and, being an annual, it does not give feed so

An area in the Carlsruhe district which has been improved greatly by sowing introduced grasses and top-dressing.

quickly as a perennial after the first autumn rains. Wimmera rye grass in fact appears to be more suitable for mixed wheat and sheep farms than for purely pastoral properties.

Phalaris tuberosa appears to be thoroughly persistent in our main pastoral areas. Small fields only are to be found here and there throughout the State, but in all cases it is more persistent than perennial rye grass in areas of relatively low rainfall. At the present time the seed is costly, and though this is a disadvantage likely to be corrected as time goes on, the need for special care in the preparation of the seed bed will always remain a necessity. The plant is extraordinarily difficult to establish, and requires a very fine and clean seed bed for a satisfactory strike. The nature of Phalaris tuberosa would seem to restrict its use also to small holdings and to small fields of larger holdings.

When it is considered that most sheep land consists of holdings from 1,000 acres to 5,000 acres in extent, the proportion of each holding likely to be laid down to these grasses cannot be very great, mainly because of the cultivation involved. As a rule it is usual to aim at improving from 10 per cent. to 20 per cent. of the larger properties, and though this may mean increasing production by from 20 to 40 per cent., it is still a long way from what is both economical and possible. Since, however, intensive cultivation of these large areas is more or less impracticable, it looks as though subterranean clover must be merely scratched into much native grass country without any attempt at the inclusion of introduced grasses. Where this is so, the problem would seem to become a choice between preserving the native grasses, and admitting those volunteer annuals like barley grass and silver grass, which increase and multiply in our clover pastures under our present methods of management.

It is usual when top-dressing at the present time to apply 1 cwt. or more of superphosphate per acre and to apply it either regularly or every second or third year. If it is applied regularly the result is an extraordinary stimulus of clover, which grows a heavy dense crop that overshadows all other plants in the spring. If it is applied every second or third year, the result is a heavy crop in the year of application, and a lighter crop in the next or subsequent years; and in both instances the question arises whether it would not be better to apply a modified dressing of superphosphate regularly every year, and at the same time to increase the total area under improved pasture. Though a modified pasture would result, it seems reasonable to expect that the native grasses would have a correspondingly

Top-dressing with an old seed drill. The grass in this paddock is too long for the best results to be obtained.

greater chance of persistence; and, although the carrying capacity per acre would be somewhat less, the net result would be a satisfactory increase on the property as a whole.

There are two more aspects of subterranean clover which are worthy of discussion. Sheep men are attaching more importance to the value and use of its seed as summer feed, and are becoming increasingly anxious to develop it. Not only is the seed valuable as a maintenance ration, but also it is a fattening diet, and sheep may be turned off clover fields in marketable condition during January and February.

A Woodend pasture improved mainly with subterranean clover and top-dressing.

If full advantage is to be taken of the clover for summer feed, it is important that the yield of seed should be high and that the burr should be readily accessible to sheep. Though the factors which determine the yield of seed by any one particular strain have not been worked out in detail, we know from the practical experience of clover seed growers that a dressing of superphosphate is a most important one in increasing yield. In fact, in the absence of a dressing of a soluble phosphatic manure, the clover seed is small and pinched and is hardly worth harvesting. Most seed growers would agree also that a better yield of seed is obtained if the clover is at least moderately grazed throughout the spring and is not allowed to grow a great bulk of leaf and stem.

September is regarded as the most critical month for subterranean clover, and many seed growers close up their fields during that month and subsequently decide on the kind of treatment to give them. If the season is promising and growth is rapid, stock are turned in and the field is moderately grazed; but if September has been dry, the clover may be given protection for the remainder of the season. The accessibility of the burr depends largely upon the strain of subterranean clover which is being grown, and may be considered along with the aspect of strain.

Of the many strains which have been isolated in the Burnley Pasture Plant Research Field since 1928, a few are now being grown commercially and seed is gradually coming on the market. It will be known that these are classified into early, mid-season and late strains according to the times at which they flower and mature in the spring. The question arises of which strain to use, and it is suggested that it is best to grow the latest strain which will flourish under the particular rainfall and soil conditions of any locality. The existence of early strains has been stressed very much during the past year or so, but the view is expressed that the function of a very early strain like Dwalganup is to extend the cultivation of the species into dry districts, and not to displace a mid-season strain like Mt. Barker from those areas where it will flourish. Apart from low leaf production, a very early strain like Dwalganup will, if it is grown in an area of relatively good rainfall, bury its burr deeply and out of the reach of sheep, the soil being moist and soft and easily penetrated at the time this strain is fruiting. Because of the high feeding value of the seed, this is a distinct disadvantage and one to be avoided if possible.

Whether a very leafy late strain like Tallarook can be extensively grown in pastoral areas has still to be discovered. It is growing on a 23-inch rainfall at Tallarook, and it will probably do best in somewhat similar localities where the rainfall is adequate and favorable conditions usually prevail until late November. It is very noticeable that the late strains bury very little of their burr and leave most of it lying on the surface of the soil where it is readily accessible to sheep.

Apple Leaf-hoppers

An Outbreak in Victorian Orchards

By Keighley M. Ward, M.Agr.Sc., Assistant Entomologist

IN the north-eastern section of Victoria a severe outbreak of apple leaf-hoppers (Jassids) occurred during the past season (1935-36). This was the first outbreak of its kind in apple orchards in this State, and in view of the nature of the damage caused, and the large number of orchards affected it is expedient to place before growers the main facts relative to the life-history and control of the insect concerned.

An examination of the nature of the outbreak was made by the writer early in February and spraying tests were carried out to determine the efficacy of certain insecticides. The full extent of the outbreak was ascertained by Mr. A. C. Bullock, Orchard Supervisor, who made a general inspection of the North-East. He reported that the insects were prevalent over a wide area, the districts affected being Stanley, Kiewa, Wandiligong, Baarmutha, Allan's Flat, and Yackandandah.

The peak of the outbreak was reached during March and by harvesting time extensive tree injury and fruit blemishing had been caused. The species of jassid concerned was *Typhlocyba australis* Frogg. For a number of years the same insect has caused damage in apple orchards in Tasmania, New South Wales and South Australia.

Economic Importance.

The injury which results from the insects' activities is such as to debilitate the trees and, to a certain extent, endanger the apple crop on them for the following season. A more serious injury involves the disfigurement of the fruit itself, as the result of deposition on it of insects' excrement. The removal of this blemish increases considerably the cost of marketing the fruit. Important apple varieties such as Granny Smith and Delicious are no less susceptible to attack than others. Fortunately the insect appears to be injurious only on apple trees. This insect must, however, be regarded as of considerable economic importance in view of the serious nature of the injury it causes, and the possibility of its extension to apple areas in other parts of the State.

Nature of Injury.

The injury caused by the apple leaf-hopper is two-fold in effect. In the first place, by sucking sap from the leaves, the insects may cause a general weakening of the tree. Early symptoms of injury are the formation of numerous, small, whitish patches on the upper surface of each leaf, as shown in Fig. 2. At a later stage of the injury, which quickly follows when the infestation is severe, the death of the leaves results and partial defoliation may occur. Extensive leaf destruction may, of course, interfere with the development of fruit and leaf buds for the next season's crop. Furthermore, if this destruction should occur relatively early in the season it is possible that the quality of the current season's fruit may be affected.

The second type of injury concerns a direct effect produced on the fruit itself. Although the insects do not usually feed on the fruit, their presence in the trees, in great numbers, results in the deposition of excrement on the skin of the fruit. When rain water or spray materials fall

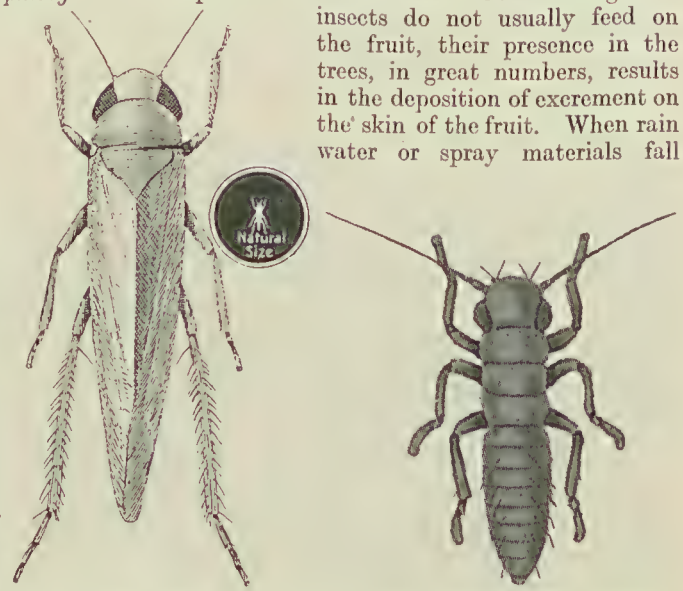

Fig. 1.—The Apple Leaf-hopper. Left, adult; Right, nymph. [After Noble.

on blemished fruit and drops of liquid run over its surface, ugly brown marks or streaks are formed. Typical fruit blemish of this kind is illustrated in Fig. 3. Figure 4 shows excrement spotting as it appears before being affected by water. These spots and the streaks can be removed only with difficulty, and then each fruit requires careful wiping with a damp cloth. In an outbreak as severe as that reported here the majority of the fruit on affected trees may be blemished by the excrement of the insect.

Fig. 3.—Blemishes on apples caused by jassid excrement.

Life History.

The first generation of jassids arises during the spring from overwintering eggs which had been deposited in the bark tissues of apple trees during the previous autumn. The young jassids (nymphs) feed on the developing apple leaves by sucking out the sap, and in about a month they develop to the adult, winged stage. Both nymphs and adults feed almost invariably on the *under sides* of the leaves. The adults readily take to flight, particularly when disturbed, but each insect usually makes a short, rather jerky flight only and then mainly within a particular tree. Flight between trees does not seem to be very general so that the spread of adults through an orchard would appear to be rather slow.

Fig. 2.—Showing jassid injury to apple leaves.

The adults of the first and any subsequent summer generations deposit eggs *within the leaf tissues*, notably in the midrib and main veins. During the final generation for the season, the adults deposit overwintering eggs in the *bark layers of the younger wood* of the tree. The position of eggs under the bark is marked by minute swellings. Figure 5 shows an enlarged section of an apple twig bearing these winter eggs. The swellings measure about one-thirtieth of an inch (0.87 mms.) in length.

The adult leaf-hopper is a small slender insect measuring about one-sixth of an inch in length. Its general colour is canary yellow, the nymph being pale yellow to pale green. The general appearance of the insect is shown in Fig. 1.

In the outbreak which occurred last season, the insects were prevalent in the apple orchards until late in April. It would appear that three generations (or two and a partial third) developed during the season.

Host Plants.—An examination was made of many potential alternate host plants of the insect. While all varieties of apples examined (Granny Smith, Delicious, Rokewood, King David, and Alfristan) were affected, the jassids could not be found on any other kinds of trees, nor on any of numerous species of weeds. Pear and plum trees adjoining heavily infested apple trees were not attacked. Mr. J. W. Evans, Government Entomologist, Tasmania, reports their occurrence on hawthorn and apple trees only.

Orchard Spraying Tests.

During the outbreak in the north-east, an endeavour was made to find a spray material which, even as late as February, might prevent the insects from causing further injury to the

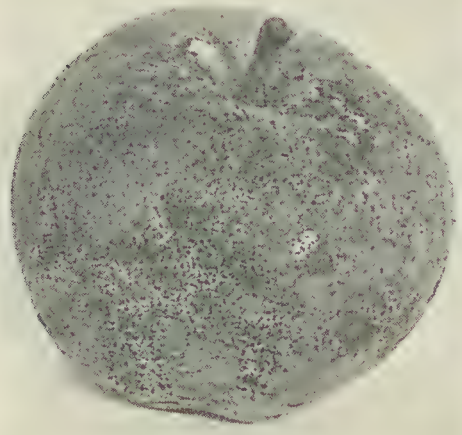

Fig. 4.—Spotting caused by jassid excrement and before being affected by water.

trees and fruit. A block of Granny Smith trees at Kiewa Valley Orchards was placed at the disposal of the Department of Agriculture for spraying tests, by the manager, Mr. W. H. Grant. Each of six treatments (see Table I.) was applied to ten trees, care being taken to reach the under side of leaves with the spray. Results obtained from each treatment are based on the percentage kill of nymphs as found on the under side of the leaves, and on the total number of live jassids found on 100 leaves taken at random from each plot 48 hours after treatment. The sprays used and the results obtained from each are shown in Table I.

The results in this table indicate clearly that a spray mixture containing nicotine sulphate effected the greatest kill of jassids and reduced the insects present to very low numbers. If the three nicotine sprays are considered alone it is evident that the addition of white oil slightly increased the killing effect of the spray. Nicotine sulphate used with lead arsenate, but without oil spreader gave a significantly inferior kill than when used with white oil, but still effected very good control of the insect. Nicotine sulphate, therefore, can be incorporated in the lead arsenate sprays applied to control codling moth, with the object of destroying jassids. The addition of white oil to the spray would slightly increase its efficiency as far as the control of jassids is concerned. Of course, soap cannot be used in arsenate of lead sprays owing to the incompatability of the two materials when mixed together in the same spray. The difference in kill obtained with nicotine plus white oil, and nicotine plus soap is not significant

The white oil sprays caused a low mortality and were definitely ineffective in reducing the numbers of jassids to non-injurious proportions. Increasing the strength of the oil did not improve

(*Continued on page* 376.

TABLE I.—SPRAYING TESTS—APPLE LEAF-HOPPERS, KIEWA VALLEY, 1936.

Spray Treatment.	Percentage Kill of Nymphs.	Number of jassids alive on 100 leaves 48 hours after treatment.
	%	
Nicotine sulphate 1 in 640 and white oil 1 in 100	99·5	4
Nicotine sulphate 1 in 640 and soft soap 2 lb. to 80 gallons	97·0	1
Nicotine sulphate 1 in 640 and arsenate of lead 5 lb. to 80 gallons.	95·0	11
Standard error—Nicotine sprays only	=0·98.	
White oil 1 in 60	56·5	141
White oil 1 in 100	57·3	317
White oil 1 in 100 + ¾ lb. casein spreader.	38·2	339
Standard error—all treatments	= 2·9.	
Unsprayed trees	0·2	474

Fig. 5.—Swellings in the bark of apple twigs, indicating the presence of winter eggs of jassids.

Thistles and Allied Plants

Their Identification and Control

By A. Morgan, B.Agr.Sc., State Research Farm, Werribee

UNDER the *Vermin and Noxious Weeds Act* 1928, ten species of thistle are proclaimed for the State, while six additional species are proclaimed within certain municipalities. Four more thistles occur fairly commonly, but are not considered weeds of major importance, and there are species naturalized in South Australia and New South Wales which will in all probability soon be found in Victoria.

The problem of noxious weeds is becoming an increasingly important one in all branches of farming, and the development of large-scale transportation methods unfortunately favours the rapid distribution of pests. No really *cheap* and *effective* herbicide such as is necessary for weed control *on a large scale* has been produced, and, until such a chemical is discovered, the problem of weed control must rest on a preventive rather than a curative basis, except where improved cultural methods are found effective. The first essential in the preventive campaign is the ability of the farmer to recognize the noxious plant before it has obtained a firm footing on his property. The following key for the identification of the thistles at present recorded in the southern States, when used in conjunction with the short non-technical descriptions given, and the illustrations, will enable any person without previous botanical knowledge to determine the name and importance of any thistle. The key is based on the colour of the flowers, presence or absence of prickles or spines on the eaves and so on—characters which can be determined at a glance, yet do not vary to any great extent with local conditions.

In a few cases it is necessary to refer to the (usually) leathery, spiny organs, known as bracts, which enclose the large number of small flowers, the whole forming the characteristic thistle flower-head. One of these may be pulled off easily from the head and its nature recognized without the aid of a lens. Note carefully that it is the colour of the *flowers inside the head* that is referred to in the key, not the colour of the bracts which form the outer covering of the head.

KEY FOR THE IDENTIFICATION OF THISTLES (IN FLOWER).

1. Plant stemless, with flowerheads set in rosette of leaves on the ground—
   See STEMLESS THISTLE
   Plant with stem; heads along or at end of branch ... ... *See* 2

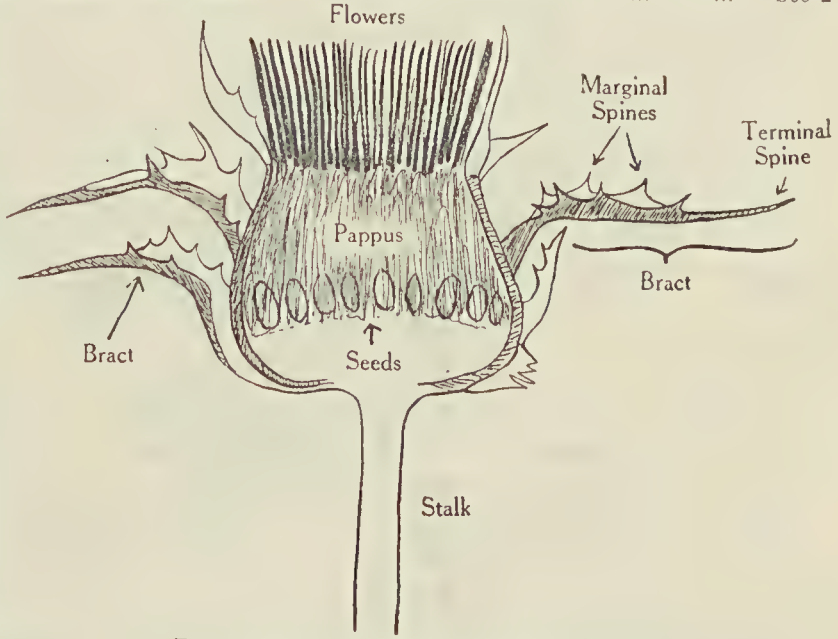

Fig. 1.—Section of typical thistle flower-head.

2. Leaves variegated ... ... *See* 3
Leaves not variegated ... ... *See* 4

3. Flowers purple ... *See* SPOTTED THISTLE
Flowers yellow ... *See* GOLDEN THISTLE

4. Flowers yellow or orange ... ... *See* 5
Flowers purple, blue, pink, or white *See* 10

5. (*Flowers Yellow or Orange*)—
Flowers orange, plant not hairy or woolly ... ... *See* SAFFLOWER
Flowers yellow ... ... *See* 6

6. Leaves spiny or prickly, stems not winged ... ... *See* 7
Leaves not spiny or prickly, stems winged ... ... *See* 8

7. Flower head visible ... ... *See* 9
Flower head not visible, being enclosed by thin green leaves; bracts narrow and comb-like because of large number of close-set spines along the margins—
(See Fig. 2, 7); *See* BLESSED THISTLE

8. Spines of outer bracts arranged like the fingers of the hand; middle one long and yellow—
(See Fig. 2, 4); *See* ST. BARNABY'S THISTLE
Spines of outer bracts arranged like backbone of a fish; middle one short and reddish—
(See Fig. 2, 3); *See* MALTA THISTLE

9. Bracts stiff, with 4 or 5 spines along each edge—
(See Fig. 2, 2); *See* SAFFRON THISTLE
Bracts with 2 or 3 small fine spines on each edge, close-set near the base—
(See Fig. 2, 18); *See* AFRICAN THISTLE

10. (*Flowers Purple, Blue, Pink, or White*)—
Flowerheads not spiny ... ... *See* 11
Flowerheads spiny ... ... *See* 14

11. Flowers blue, bracts with comb-like margins— *See* BLUE CORNFLOWER
Flowers purple or white ... ... *See* 12

12. Bracts brown to black, with conspicuous fringe—
(See Fig. 2, 11); *See* KNAPWEED
Bracts not fringed ... ... *See* 13

13. Lower leaves with long narrow opposite teeth cutting back almost to the mid-rib ... ... *See* TERRIBLE WEED
Lower leaves stalkless, with coarse teeth, but the teeth not opposite and not cutting back to near the mid-rib. Roots black ... ... *See* HARDHEADS

14. Leaves not prickly or spiny *See* STAR THISTLE
Leaves prickly or spiny ... ... *See* 15

15. Stems conspicuously winged ... *See* 18
Stems not winged, or winged only for a short distance below each leaf ... *See* 16

16. Perennial, growing 1 to 2 feet high, with creeping underground roots *See* PERENNIAL THISTLE
Annual or perennial, growing 3 feet or more high, without creeping underground roots ... ... *See* 17

17. Perennial, the heads large, the leaves white— *See* ARTICHOKE THISTLE
Annual, the heads small-medium in size, the leaves green— *See* SYRIAN THISTLE

18. Bracts ending in a branched spine—
(See Fig. 2, 9); *See* SOLDIER THISTLE
Bracts ending in a single unbranched spine— (See Fig. 2, 13 to 16); *See* 19

Fig. 2.—Bracts of various thistles, showing shape and arrangement of spines.

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19. Spines of head both orange-coloured and long— *See* SCOTCH THISTLE
Spines of head *not both* orange-coloured and long ... ... *See* 20
20. Bracts woolly ... *See* SPEAR THISTLE
Bracts not woolly ... ... *See* 21
21. Bracts broad and purplish— *See* ILLYRIAN THISTLE
Bracts narrow and not purplish ... *See* 22
22. Heads globular, clustered; flowers purple— *See* CRISPED THISTLE
Heads narrow, clustered; a white-woolly plant; flowers usually pink or white ... ... *See* SLENDER THISTLE

Identification of a Specimen.

To understand the working of the key for identification more clearly, the following example is given:—

In identifying a thistle from this key, the first thing to be decided is whether the plant is stemless or carrying a stem. If the thistle has a stem, see 2. Are the leaves variegated or not variegated? If they are not variegated, see 4. Are the flowers yellow or orange, or are they purple, blue, pink, or white? If they come within the latter group, see 10.

Are the *flower heads* spiny or not spiny? If they are spiny, see 14. Are the *leaves* prickly or spiny, or are they not? Let us suppose they are, see 15. If on examination it is decided that the stems are not winged, or, if so, only for a short distance below each leaf, see 16.

Finally, the specimen (for example) proves to be a perennial, growing 1 to 2 feet high, with creeping underground roots, and is identified therefore as PERENNIAL THISTLE.

Fig. 3.—Left, Male head of Perennial Thistle; Centre, Female head of same thistle; Right, Head of Crisped Thistle (Carduus crispus). [Board Agric. & Fish, Leaf. 166.

DESCRIPTIONS OF THISTLES.

Species Proclaimed Noxious for the Whole State.

PERENNIAL OR CALIFORNIAN THISTLE.

Other Common Names.—Creeping Thistle, Corn Thistle, Canadian Thistle, Field Thistle, Cursed Thistle, Small-Flowered Thistle.

Botanical Name.—Cirsium arvense Scop. (*Cnicus arvensis* L.; *Cnicus arvensis* Hoffm.; *Carduus arvensis Robs.*)

Heads in branched group topping the stem.
Flowers bright purple, occasionally white.
Bracts narrow, with a single terminal spine.
Leaves vivid-green, clasping the stem slightly at the base, and with coarsely-toothed spiny margins, frequently whitish on the under side.
Stem shows fine line markings along it, and is occasionally shortly winged.

This is the most troublesome of the thistles on account of its habit of spreading extensively underground, sending up numerous shoots, so that a single plant soon develops into a large patch without the necessity for seeding.

Because of the peculiarity that two types of flower-head are produced on separate plants, in one of which the majority of the mature seeds occur, "male" and "female" plants are easily distinguished, each type often forming a large separate patch.

Many farmers believe that *all* the seed produced is infertile, but although the amount of fertile seed produced is apparently very low in some seasons, there is always a percentage of seeds which will germinate quite readily in the same year or in the following spring. From the seedling, a thin taproot descends into the soil, and many buds capable of forming new shoots develop along this root and upon the subsequent secondary roots. While the plant is still relatively inconspicuous above-ground, therefore, it has established a considerable rooting system deep into the soil, and, what is more important from the point of view of control by cultivation, any part of the root-system can form a new plant if distributed by implements while the soil is moist. *See* Control Measures.

SAFFRON THISTLE (Woolly Star Thistle).

Botanical Name.—Carthamus lanatus L. (*Kentrophyllum lanatum* DC.).

Heads solitary, set amongst small spiny leaves, elongated.
Flowers bright yellow.
Bracts ends in a stiff spine, and have four or five spines along each margin.

Leaves olive-green, stiff, deeply cut into spiny lobes.
Stem not winged.

A downy or hairy annual, usually 1 to 2 feet high.

MALTA THISTLE (Maltese Cockspur).

Botanical Name.—Centaurea melitensis L.

Heads solitary or two to three together, stalkless, arising from among a few leaves at the ends of the branches.
Flowers yellow.
Bracts broad, ending in a short reddish spine, the other spines being arranged along it like the backbone of a fish. (See Fig. 2, 3.)
Leaves.—The leaves of the rosette and along the base of the stem are somewhat irregular in outline, but the top leaves have plain margins. Prickles are absent from all leaves.
Stem winged.

This is a rough-hairy annual, 1 to 4 feet high, easily distinguished from St. Barnaby's Thistle by the arrangement of the prickles of the bracts, as shown in Fig. 2, 3.

ST. BARNABY'S THISTLE (Yellow Cockspur. Yellow Star Thistle).

Botanical Name.—Centaurea solstitialis L.

Heads solitary, shortly stalked.
Flowers yellow.
Bracts broad, ending in a long yellow spine, with the other spines arranged at its base like the fingers of the hand. (Fig. 2, 4.)
Leaves non-prickly, similar to Malta Thistle in shape, the lower leaves being irregular in outline, and the upper leaves with plain margins.
Stem winged.

A stiff, erect, more or less woolly annual, 1 to 2 feet high.

STAR THISTLE (Calthrops).

Botanical Name.—Centaurea calcitrapa L.

Heads solitary, usually stalkless, among a few small leaves.
Flowers purple (or occasionally white).
Bracts broad at the base, ending in a long stout yellow spine with 4 to 6 smaller spines along its basal margins. (These latter absent if flowers infertile.)
Leaves.—Except for the small leaves among which the heads are set, the leaves are deeply cut to form narrow paired "leaflets" (see coloured plate), and are non-prickly.
Stem not winged.

A sparsely hairy or slightly woolly annual or biennial, with a thick taproot. It is profusely branched, and in sandy soil may send out long runners. It grows 1 to 2 feet high.

ARTICHOKE THISTLE (Wild Artichoke, Cardoon).

Botanical Name.—Cynara cardunculus L.

Heads solitary, very large, and ornamental when in full bloom. Borne on short stalks.
Flowers purple.
Bracts very broad at the base, and fleshy; end in a single stout spine. (See Fig. 2, 6.)
Leaves white and woolly in appearance, deeply divided into lobes ending in strong yellow spines.
Stem ribbed and winged.

Although a perennial plant, it does not spread by underground roots in the same manner as the Perennial (Californian) Thistle; still, it produces a large number of fertile seeds, and although some small birds eat a large percentage of these while still immature, the spread of the plant can be rapid owing to the wholesale distribution of seeds.

It grows up to 6 feet high, and the spread of the lower leaves is correspondingly large so that the value of a pasture is considerably reduced due to the choking out of other more useful vegetation.

Fig. 4.—Blessed Thistle (Cnicus benedictus) showing leaf, flower and head.

SACRED OR BLESSED THISTLE (Bitter Thistle).

Botanical Name.—Cnicus benedictus L. (*Carbenia benedicta* Adans.).

Heads without stalks, sheathed in the upper leaves.
Flowers yellow.
Bracts narrow, ending in a long spine, with a row of smaller spines, closely spaced along each margin, giving the whole bract a comb-like appearance.

Fig. 5.—Some Common Thistles.

1a, Saffron thistle, 1b, bract, and 1c, flower of Saffron thistle; 2a, Flower, seed head, and bracts of Malta thistle, 2b, Malta thistle; 3a, Star thistle, 3b, bract of Star thistle; 4, St. Barnaby's thistle; 5a and 5b, Artichoke thistle.

Leaves thin, green, and prickly; the lower ones stalked, the upper leaves with clasping bases; all 3 to 6 inches long, and jagged with unequal teeth. Spiny along the margins.
Stem branching, rather hairy.

An annual which derives its name from its use in medieval medicine.

Syrian Thistle.

Botanical Name.—Cirsium syriacum Gaertn.

Heads large, surrounded by a few narrow spiny leaves.
Flowers purple.
Bracts.—The outer bracts end in a single short unbranched spine.
Leaves irregular in outline, and spiny.
Stem only slightly winged, if at all.

This thistle, which grows 3 to 5 feet high, is similar in some respects to the Perennial Thistle, but on account of its *annual* nature it is not so dreaded as a weed. It does not show the "male" and "female" heads typical of Perennial Thistle.

Purplish Cornflower or Terrible Weed.

Botanical Name.—Centaurea paniculata L.

Heads very small, solitary on the numerous branches, not prickly.
Flowers purple.
Bracts chaffy, with no spines, and no conspicuous fringe or other character.
Leaves small and sparse on the stems. The lower leaves are deeply cut to form narrow teeth, arranged like a fish backbone. There are no spines or prickles present.
Stem rigid, wiry, and cottony.

The head of this perennial plant, although small and devoid of prickles, is definitely of the thistle conformation. As a weed, it is not well known in this State, only a single record of it being made, but it is recorded in Black's "Flora of South Australia" as a recent arrival in that State. Any plant answering to its description should be destroyed at once with a view to preventing its spread in Victoria.

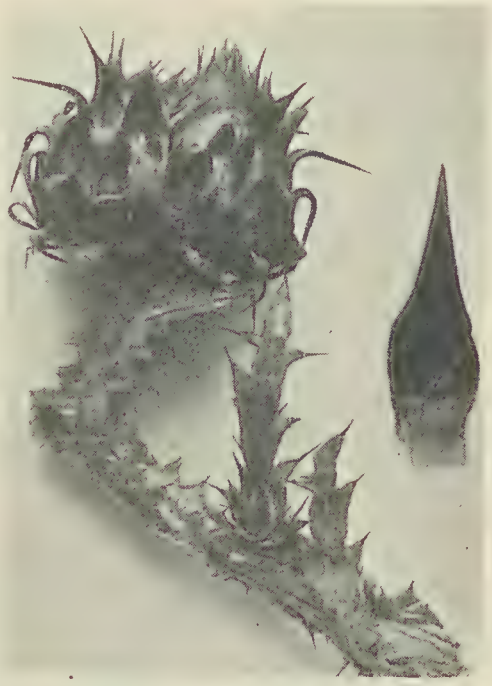


Fig 7.—Illyrian Thistle.

Illyrian Thistle.

Botanical Name.—Onopordon Illyricum L.

Heads of medium size, very shortly stalked, usually solitary spiny.
Flowers purple.
Bracts purple, broad, ending in a short spine. (See Fig. 2, 10.)
Leaves white, woolly, coarsely toothed, with spiny margins.
Stem white, woolly, winged and spiny.

This plant is an erect white-woolly thistle with a strong taproot; although recorded from one locality only, to date, it is known elsewhere as a bad weed, and should be watched for and destroyed. Its proclamation in 1933 as a noxious weed for the State may prevent it gaining ground here.

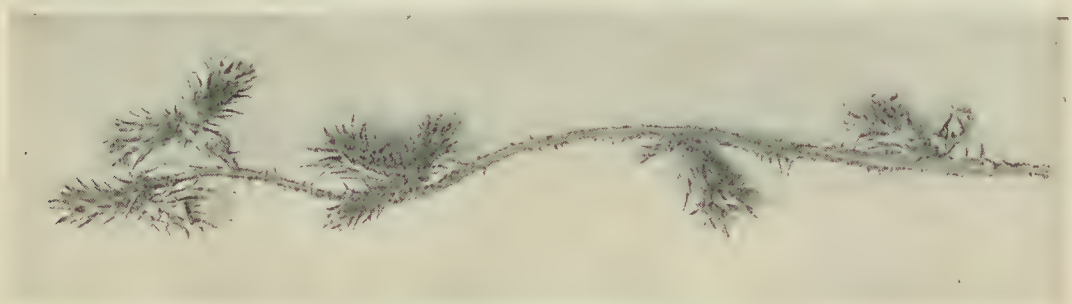


Fig. 6.—Slender or Shore Thistle.

Thistles Proclaimed Noxious Weeds within certain Municipalities.

SLENDER OR SHORE THISTLE.

Botanical Name.—Carduus pycnocephalus Jacq. (*C. tenuiflorus* Curt.).

Heads rather small, borne in clusters, stalkless, spiny.

Flowers pink, white or purple.

Bracts narrow, ending in a straight or curved unbranched spine.

Leaves prickly, with irregularly lobed-toothed margins, woolly below.

Stems winged and spiny, somewhat woolly.

The Slender Thistle is a stiff, but rather slender annual or biennial, occurring commonly in Victoria, and frequently prominent near the coast. It usually has a cotton-woolly appearance. Professor Ewart gives *C. tenuiflorus* Curt. as a synonym for *C. pycnocephalus* Jacq. in his "Flora of Victoria," while Mr. J. M. Black, in the "Flora of South Australia," gives differences between *C. tenuiflorus* Curt. and *C. pycnocephalus* L. The multiplicity of generic and specific names for thistles is particularly confusing. The plant is proclaimed for Colac, Warrnambool, Port Fairy, Koroit, Bairnsdale, and Northcote.

SPOTTED OR MILK THISTLE (Lady's Thistle, Variegated Thistle).

Botanical Name.—Carduus Marianus, L. (*Silybum Marianum Gaertn.*).

Heads large, solitary at the ends of the branches, with conspicuously spreading spines.

Flowers purple.

Bracts stiff and fleshy, spreading or recurved, ending in a stout spine up to 1½ inches long, and with several smaller marginal spines towards the base. (See Fig. 2, 12.)

Leaves.—The first two leaves (cotyledons) produced after germination are not variegated and their margins are plain; all subsequent leaves produced are variegated by white veins on the smooth shining upper surface, and are deeply and irregularly toothed. The leaves are prickly, and along the upper part of the stem they have clasping bases.

Stem not much branched, not winged.

The Spotted Thistle is usually biennial, though sometimes annual, and may grow to 12 feet high. It seeds freely, and large numbers of plants develop, forming a dense impenetrable prickly clump. Apart from this it is not perhaps as objectionable as the other thistles, since though spiny it is of a soft herbaceous consistency and makes ensilage of moderate fodder value. The large heads with purple flowers, in conjunction with the variegation of the leaves, are sufficient to identify it. It shows a preference for moist situations. Like Sorghum and Sudan grass, freshly cut plants of Spotted Thistle are poisonous at certain times.

The Spotted Thistle is proclaimed for Colac, Koroit, Avon, Belfast, Port Fairy, Heytesbury, and Maffra.

Fig. 8.—Spotted or Milk Thistle.

SPEAR THISTLE (often miscalled "Scotch Thistle"—*See* true SCOTCH THISTLE).

Botanical Name.—Carduus lanceolatus Scop. (*Cirsium lanceolatum* L.; *Cnicus lanceolatus* Hoffm.).

Heads spiny, medium-sized, very shortly stalked, solitary or two together terminating the branches.

Flowers purple.

Bracts narrow, ending in a single unbranched spine.

Leaves with large teeth, ending in spines, the margins spiny, usually white and woolly below.

Stems winged and spiny, furrowed and hairy.

This thistle is probably so well-known that except for purposes of comparison with other species, any description is superfluous. It is a biennial, reaching a height of 2 to 4 feet. Proclaimed for Colac and Koroit.

HARD-HEADS (Turkestan Thistle, Russian Knapweed).

Botanical Name.—Centaurea picris Pall. (*Centaurea repens.*).

Heads small.
Flowers purple to white.
Bracts not spiny, bearing a small membranous flap at the tip.
Leaves narrow, stalkless, mostly under 1 inch long, with no spines; coarsely toothed bottom leaves and a few small teeth on upper leaves.

A slender, branched, slightly woolly perennial, with black creeping roots, reaching a height of 1 to 2 feet. A proclaimed weed for Kerang and Swan Hill.

GLAUCAUS STAR THISTLE.

Botanical Name.—Carthamus glaucus Bieb. [*Kentrophyllum glaucum* (Bieb.); Fischer et Mey.].

Heads small, surrounded by a few small spiny leaves.
Flowers purple.
Bracts narrow and spiny.
Leaves narrow, 1 to 2 inches long, with a spiny tip and 2 to 4 pairs of marginal spines.
Stems white, irregularly branched.

This very prickly annual thistle resembles Saffron Thistle except for its purple flowers (instead of yellow) and its usual absence of woolliness. It is proclaimed for Kowree and Glenelg.

Fig. 10.—Hardheads.

STEMLESS THISTLE (Stemless Onopordon).

Botanical Name.—Onopordon Acaulon L.

Heads large, globular, spiny, occurring several together in rosette of leaves on ground surface.

Fig. 9.—Spear Thistle.

Flowers white.
Bracts rather narrow, ending in a single unbranched long spine.
Leaves large, white-woolly on both sides, with spiny wavy lobes.
Stem.—None.

A biennial which is easily recognized, as it is the only thistle recorded to date in Victoria which does not send up a stem. At present it is most common in the north-west of this State. Proclaimed for Karkarooc, Borung, Birchip, Wycheproof, and Swan Hill in 1930.

Thistles which are Not Proclaimed Weeds.

Crisped Thistle (Welted Thistle).

Botanical Name.—Carduus crispus L.

Heads medium-sized (see Fig. 3), globular, spiny, clustered.
Flowers purple.
Bracts narrow, with a spreading or curved terminal spine.
Leaves rather narrow, prickly, and with irregular margins.
Stem winged and prickly, more slender than spear Thistle.

This annual or biennial species is widely spread in Victoria. As in the case with Spear Thistle, it often has more than one strong root (see Control Measures).

Knapweed (Hard-heads Knapweed).

Botanical Name.—Centaurea nigra L.

Heads globular, terminating branches, non-prickly.
Flowers purple.
Bracts end in a brown or black flap of fringed tissue instead of a spine.
Leaves.—Lower leaves coarsely toothed or lobed, rather narrow; upper leaves with very few teeth, if any, and with the base clasping the stem. None of the leaves are prickly.
Stem not winged, but lined, and somewhat hairy.

The heads are of the characteristic thistle shape, though neither they nor the leaves and stems are spiny. The fringes of the bracts are very conspicuous and should serve to identify the plant (see Fig. 2, 11). It is a perennial growing to 1 to 2 feet high, and is widely spread in Victoria.

Safflower.

Botanical Name.—Carthamus tinctorius L.

Heads not spiny, tapering upwards, surrounded at base by a few small leaves.
Flowers orange-coloured, forming a conspicuous crown over the head.
Bracts prominently ribbed, pointed, but not spiny.
Leaves broad, with or without toothed margins, non-prickly.
Stem pale, not winged.

Safflower has been long cultivated to provide a substitute for saffron, and is widely spread in Victoria, though not particularly common. It is a non-hairy branched annual growing 1 to 3 feet high. The absence of prickles and hairs on the plant, in conjunction with the orange flowers, are sufficient to identify it.

Golden Thistle.

Botanical Name.—Scolymus hispanicus L.

Heads stalkless, set between the stem and the upper leaves, and containing only a very few flowers (usually two or three), prickly.
Bracts pointed and prickly.
Flowers yellow.
Leaves.—At base, 6 to 10 inches long, stalked, and variegated with light spots. Margins irregular, prickly.
Stem winged and prickly.

The Golden Thistle is a garden escape, widely spread but not common in this State. It is a biennial, growing 2 to 3 feet high, with an edible root (when cultivated).

Scotch or Heraldic Thistle (Cotton Thistle).

Botanical Name.—Onopordon Acanthium L.

Heads large, arranged in a group topping the stems, or along the stem near the top, spiny.
Flowers purplish.
Bracts woolly at the bottom, ending in a long unbranched orange-coloured spine.
Leaves very spiny along the margins, which are toothed or cut, and wavy. Leaves white-woolly. (Var. *viride* Miehet—leaves green above.
Stems white-woolly, with broad spiny wings.

The plant is a biennial, 2 to 6 feet high, and is reputed to be poisonous. Although the supposed heraldic thistle of Scotland, it is not native to that country, and is rare there.

Soldier Thistle.

Botanical Name. — Cirsium Acarna L. Moench. (*Picnomon Acarna* (L.) Cass.)

Heads stalkless, single or 2 to 4 together among several leaves at the end of the branch, these leaves being longer than the head but not concealing it. Heads spiny.
Flowers purple.
Bracts narrow, with a recurved terminal spine bearing 2 to 8 smaller marginal spines; woolly below the spines. (Fig. 2, 9.)
Leaves somewhat narrow, white-woolly, the margins cut into lobes ending in long yellow spines, and the remainder of the leaf edge bearing small spines.
Stem stout, erect, winged, spiny.

This plant is recorded as naturalized in certain districts of South Australia, and may find its way into Victoria, where it should be attended to if recognized. Its name indicates

its aggressively spiny character. It is a white-woolly annual, related botanically to the ubiquitous Spear Thistle.

Blue Cornflower (Cornflower).

Botanical Name.—Centaurea cyanus L.

A garden plant which occasionally escapes as a weed. Although unimportant, at present, as far as Victoria is concerned, it has become an undesirable weed in other countries, and any infestation should be promptly suppressed.

Note.—African Thistle (*Berkheya rigida* Thunb.), a hairy thistle-like plant, has become established around Port Phillip during recent years, and should be eradicated where found. The heads are small, stalked, and spiny; the flowers are yellow the bracts are woolly, with a terminal point (not a spine), and with paired spines near the base; the leaves are irregular-margined, spiny, white on the under surface, and 2 to 4 inches long.

Control Measures.

From the point of view of control, the thistles fall into two main groups: (1) the perennials, and (2) the annual or biennial group. Members of the former are more difficult to eradicate as far as the single plant is concerned, but those of the latter often more than make up for their annual-biennial character by heavy seed production and the presence of a feathery apparatus, called the *pappus,* which enables the seed to be carried long distances by wind and water.

The first-named group includes the Perennial (Californian) Thistle, Artichoke Thistle, Purplish Cornflower, Knapweed, and Hardheads, while the strictly annual species are the Saffron Thistle, Malta Thistle, St. Barnaby's Thistle, Sacred Thistle, Syrian Thistle, Safflower, and the Glaucous Star Thistle. The biennial thistles are Star Thistle, Spotted Thistle, Spear, Thistle, Slender Thistle, Stemless Thistle, Scotch (Heraldic) Thistle, Crisped Thistle, and the Golden Thistle. Many of these may be annual or biennial.

The perennials offer the hardest problem in control, because of the necessity for destroying the root system as well as the top growth, and in this respect the Perennial Thistle is most troublesome. Unless pressed for food, stock usually neglect it, and except on small patches, chemical treatment is too expensive at present. The most practical method of dealing with it on pasture land is to attempt to build up the legume content with subterranean or white clover, choosing the species according to the rainfall and other local conditions, and to promote their vigor, and that of the pasture also, by adequate phosphatic manuring. Thorough grazing of the area at fairly regular periods, according to the feed, and supplementing this with cutting, will help to prevent the distribution of seed. Such methods will not eradicate the pest entirely, but will reduce it to inconsiderable proportions if persisted with. Cutting late in the season is practically useless; to diminish the vigor of the plant it must be hoed early, soon after coming above ground, and the oftener this is repeated, the better. Such methods, if carried on for three seasons, usually result in almost complete eradication.

Small patches in both cultivated and pasture land may be eradicated by smothering with strong tarred paper, or by the use of carbon bisulphide sealed in holes punched or bored into the ground. Sodium chlorate applied as heavy dressings of the dry salt, or common, crude salt, or arsenical sprays may be used—the latter method is the more difficult to employ successfully because the choice of conditions is an all-important factor in success. The details of the various methods are, for all practical purposes, the same as those employed for hoary cress, which were described in the *Journal of Agriculture* for January, 1934, and April, 1935.

Large infestations of cultivated land can be kept in check by more intensive cultivation methods, although there is an added risk of spread if not carefully carried out, but in such cases, the aim is more to take off a profitable crop than to control the weed. Similar methods to those outlined above are applicable to other perennial weeds with spreading root-systems.

The Artichoke Thistle does not present the same problem in control because it spreads only by seed, so that it can be checked by the prevention of seeding, and the plant root-system can be destroyed by fewer hoeings. Because of its large spread it is usually necessary to use a slasher to remove the top-growth before hoeing. Old plants must be removed with a mattock or chisel-ended pick, or even dug out, as the roots become very strong and woody. If such cutting is delayed until the stems are well developed, seed may be produced, and it is often necessary to pile and burn the thistles.

The annual and biennial thistles are more easily eradicated insofar as the plant is concerned, although in many cases the rapidity with which they spread makes delayed control

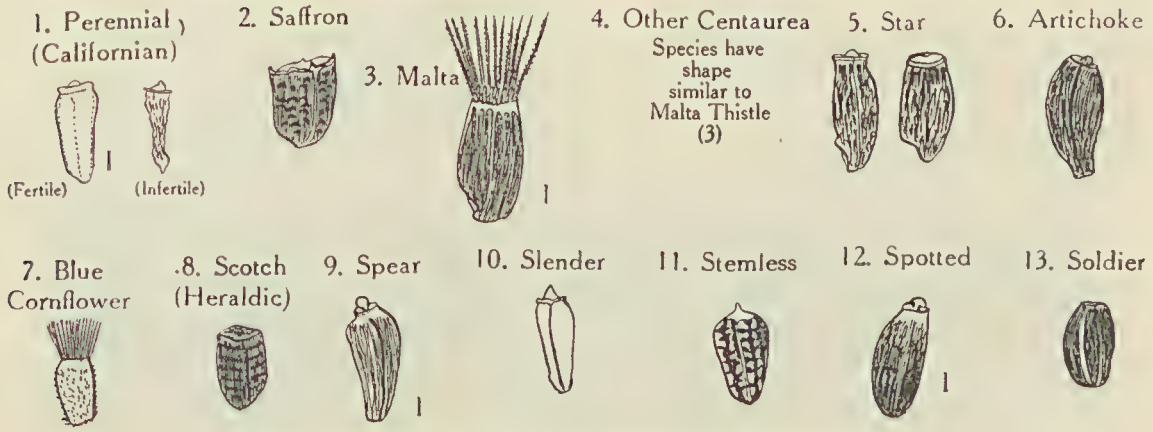


Fig. 11.—Showing the shape of the seed of various thistles.
(Variously enlarged.)

a very laborious and expensive business. All the annuals may develop as biennials under favorable circumstances, or if flowering is prevented. The essential feature of control is early hoeing, taking care that *all* the main roots are cut. The common Spear Thistle, for example, often has more than one main root, and if all are not severed the production of seed may occur after hoeing. It is cheaper to do the hoeing between the rosette stage and the commencement of flowering, except of course where only a few are becoming established, when they should be dealt with in the rosette stage. On a large scale, ploughing and cultivation have to be resorted to. Spraying is recommended only when thistles have got to the flowering stage and it is necessary to ensure that no viable seed will be produced. Any cheap herbicide carefully applied, with a follow-up treatment for those showing any sign of recovery, will be satisfactory with the annual species.

Another important preventive measure is the sowing of clean seed. The seeds of the various thistle species are illustrated in Fig. 11, which should serve as a guide to prospective purchasers of grain for seeding purposes.

Fertilizers Act

Prosecution for Offence

AT the Geelong Court of Petty Sessions on the 29th May a case under the *Fertilizers Act* 1928 was heard before a Bench of local Justices of the Peace.

The defendants, the Geelong and Cressy Trading Co. Ltd. of Malop-street, Geelong, were charged under sections 16 and 17 of the Act. Mr. W. Nunan of the Crown Law Department appeared for the prosecution, and Mr. Just for the defendants.

Mr. W. C. Robertson, chemist of the Department of Agriculture, stated that a sample of Cresco Mixed Manure No. 3 which was withdrawn from a parcel found in the possession of defendants when analysed had proved to be deficient in nitrogen and potash to an extent exceeding the limits allowed by the Act, the percentage deficiency in nitrogen being 7.76 and of potash 9.09, and that—

the calculated value per ton as sampled was £8 17s. 6d ;

the calculated value per ton as guaranteed was £9 5s. 6d.

Defendants were found guilty and were fined £2 with £7 4s. costs.

Portion of the Red Poll Herd at the State Research Farm.

Tubercle Free Herds

By R. J. de C. Talbot, B.V.Sc., Chief Veterinary Inspector.

A LITTLE more than twelve months ago the Department of Agriculture inaugurated a voluntary Accredited Tubercle Free Herd Plan, and owners were invited to enter into an agreement with the department, to submit all cattle on their properties to the tuberculin test, such test to be carried out by a veterinarian approved by the Chief Veterinary Inspector.

Many owners have applied for accreditation, and the herds shown in the accompanying table, having complied with the conditions of the scheme, are accredited as tubercle free.

Details of Scheme.

A tuberculosis-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual physical examinations and tuberculin tests, or, upon disclosure of infection, three semi-annual, successive physical examinations and tuberculin tests applied by a State Veterinarian or by a qualified and registered veterinarian who is approved by the Chief Veterinary Inspector for that purpose.

When an accredited herd or a herd in the process of accreditation is to be tested at the expense of the owner by an approved veterinarian the following regulations are to be observed :—

1. The tuberculin test shall be applied on dates approved by the Chief Veterinary Inspector, and shall be of the kind specified by him.
2. The approved veterinarian shall not conduct such tests until after he has received written authorization from the Chief Veterinary Inspector.
3. The approved veterinarian shall submit a report of such tests in accordance with the requirements of the Chief Veterinary Inspector, who reserves the right to supervise any tests conducted by an approved veterinarian.

An accredited herd shall be retested every twelve months until three clean tests have been completed, after which, testing may be carried out every second year at the discretion of the Chief Veterinary Inspector. In addition, the entire herd, or any cattle in the herd, shall be tuberculin tested or retested at such times as deemed advisable by the Chief Veterinary Inspector, and no

ACCREDITED TUBERCLE FREE HERDS.

Herd Number	Name.	Address.	No. in Herd.
1	State Research Farm	Werribee ..	259
2	Warragul High School	Warragul ..	35
3	Payne A. E. T. ..	"Yarra View," Lilydale	80
4	Dennis, Mrs. A. A. ..	Frankston ..	14
5	Slaney, H. B. ..	Mornington ..	85
6	Hope, G.	Lady Talbot Milk Institute, Cranbourne	418

animal shall be presented for the tuberculin test which has been designated as a reactor at any time.

It is required that reactors to the tuberculin test shall be immediately isolated and shall subsequently be removed from the herd by arrangement with the owner, and such arrangements may vary in accordance with the decision of the Chief Veterinary Inspector.

Any animal from an accredited herd or a herd in the process of accreditation which is allowed to come into contact with untested cattle or to run on land which has been occupied by untested cattle during the preceding three months shall be subject to retest before being returned to the property of the owner, and one additional test applied in from sixty (60) to ninety (90) days, and during such period shall be kept separate from the herd.

Calves shall not be fed milk or other dairy products except—

1. When such milk or other dairy products have been produced by a herd that is under the plan, or
2. When the milk or other products from outside or unknown sources shall have been pasteurized by heating to 145° F. for thirty (30) minutes.

With regard to keeping herd records, the herd owner is required to establish satisfactory evidence of the identity of each registered or grade animal, the animal to be marked by a tag or other marking satisfactory to the State Authority. Further, each herd owner is required to keep a record of all additions and removals of cattle from the herd by sale, death, or slaughter.

It will be necessary for all vehicles to be cleaned and disinfected before they are used for transporting cattle to herds maintained under this plan.

The only cattle which may be added to an accredited herd are :—

1. Those originating directly from an accredited herd.
2. Those originating directly from a once-tested free herd, on passing one additional test applied after being kept in isolation for a period of from 60 to 90 days.

Cattle may be added to a once-tested free herd without further test providing they originate from—

1. Accredited herds.
2. Once-tested free herds.

Cattle may be added to herds in the process of accreditation from which all reactors have been removed :—

1. From accredited herds, and once-tested free herds, without further test.
2. When two tuberculin tests have been passed, the first applied not less than 60 days before introduction, and one immediately prior to entry, the cattle having been kept in isolation during the whole period intervening.
3. Under conditions to be determined by the Chief Veterinary Inspector, and depending upon the state of health of both the herd of origin and the herd undergoing accreditation.

In addition, any cattle remaining in infected herds shall not be added to herds in process of accreditation except by special permits.

If a retest of an accredited herd discloses not more than one reactor, such herd may be re-accredited, provided the entire herd shall pass a retest applied not less than four months from the date of the previous test. If a retest of an accredited herd discloses more than one reactor, the regulations governing the tuberculin-testing of infected herds shall apply.

This agreement between the Department and the owner may be cancelled at any time, by either party.

A list of tubercle-free herds will be published in the *Journal of the Department of Agriculture* from time to time.

Lice on Horses

Quantity of Nicotine Sulphate

IN the article entitled "Parasites of the Horse" which appeared in the June, 1936, Issue of this *Journal*, Treatment No. 3 (page 288) for lice on horses should have read as follows :—

3. *Nicotine sulphate* (Black leaf 40), 1 oz. mixed in 1 gallon of soapy water. Scrub this lotion in well with a stiff brush, leave solution on the horse and allow to dry in the sun. Repeat in two to three weeks.

Butter Production and Export

The following tables show :—

(*a*) Factory production of butter and cheese in Victoria for the period July, 1935, to January, 1936, and for the months of February, March, and April, 1936, compared with the corresponding periods of 1934 and 1935 ; and

(*b*) Quantities and percentages of various grades of bulk butter examined in Victoria from 1st July, 1935, to 30th May, 1936, in comparison with the corresponding period of 1934–35.

(*a*) Factory Production of Butter and Cheese in Victoria (Quantities in Tons).

Month.	Butter.		Cheese.	
	1935–36.	1934–35.	1935–36.	1934–35.
July to January (inclusive)	48,134	44,073	3,533	2,930
February	4,613*	5,105	326*	352
March	3,591†	4,401	264†	307
April	2,807†	3,933	208†	320
Totals, nine months ..	59,145	57,512	4,331	3,909

* Revised. † Subject to revision.

(*b*) Bulk Butter Examined for Export in Victoria (Quantities in Tons).

Period.	1935–36. How Graded—				Total.	Period.	1934–35. How Graded—				Total.
	Choice.	1st.	2nd.	Pastry.			Choice.	1st.	2nd.	Pastry.	
1st July to 2nd May	22,268	11,623	2,795	419	37,105	1st July to 4th May ..	15,682	17,598	3,207	483	36,970
3rd May to 30th May	36	29	37	11	113	5th May to 1st June ..	788	302	83	5	1,178
Totals 1st July to 30th May ..	22,304	11,652	2,832	430	37,218	Totals 1st July to 1st June ..	16,470	17,900	3,290	488	38,148
Percentages ..	60·0	31·3	7·6	1·1	..	Percentages ..	43·2	46·9	8·6	1·3	..

PASSION FRUIT PRESERVES

BY MISS A. KNIGHT.

THE delicious flavour of passion fruit tends to make it a favorite for beverages, salad dressings, cake frostings, sponge fillings, &c. Both the pulp and the juice may be preserved easily in the home and held in readiness for future use. The process is a simple one and requires only ordinary cooking utensils and preserving jars. With a few jars of strained passion fruit juice on hand, many nice drinks, and appetizing dainties can be prepared quickly when required. For preserving the juice of this luscious fruit, some airtight jars would be needed, and either a double boiler or a boiler that is deep enough to hold the jars when standing on a small wooden or wire support.

The fruit should be halved, and the pulp scooped out. In order to remove the seeds (which are often considered an objection) the pulp should be heated gently, in a double boiler, to a temperature of 150° F., and then allowed to become cold. With an egg whisk or mayonnaise mixer, beat the pulp rapidly, which will loosen, and free the pips. The juice can then be strained through a sieve. The sieve need not be too fine, but fine enough to retain the seeds and any raggy portion of the pulp. If it is desired to sweeten the juice and so have it ready for use, the sugar should be melted in a small quantity of water, and boiled to thread degree, then allowed to cool before adding it to the fruit juice. Very often it is an advantage to add a little citric acid to the mixture. This will intensify the fruity flavour of passion fruit. The quantity of sugar usually desired is from 8 to 10 oz. to the quart of pure juice, and ¼ teaspoon of citric acid crystals.

After blending these ingredients in the bowl, pour the juice into the jars and pasteurize it at a temperature of 150° F. for 30 minutes, then hermetically seal the jars immediately. Preserved in this manner, the passion fruit is always ready for serving as a fruit punch, mixed with other suitable fruit juices, mineral or soda water, or for flavouring various dressings, cake fillings, &c.

Passion fruit may be preserved also as a pulp. It is then very useful for making many different dishes, as well as improving jams made from fruits containing little flavour in themselves, such as melon and pears. When preserving the pulp, choose rather small preserving jars as a little of this strongly flavoured pulp goes a long way, and when once a jar of it is opened, the contents must be used almost at once.

Take the passion fruit fully ripe, halve them, scrape the pulp into the preserving pan, and bring it to the boil. In the meantime, sterilize the jars and a jug or ladle by putting them into a pan of cold water and gradually bringing to the boil. When the pulp has boiled about 20 minutes, lift the pan on to the work table, remove the jars from the hot water, and either bind them with a wet cloth or stand them on one. Place the rubber rings in position on the jars, ladle in the hot pulp and immediately seal thoroughly air-tight. Leave the hot jars on the wet cloth until they become cold.

If preferred, the seeds may be removed by rubbing the pulp, after cooking, through a sieve, but if this be done, the strained pulp must be returned to the preserving pan and brought to boiling heat before bottling. If a sweetened pulp is desired, sugar may be added before cooking; say from ¼ to ½ a cup to every 2 cups of pulp, according to individual taste.

Another method of preserving the pulp is to put it straight from the shells into the preserving jars, filling them to within 2 inches of the top and sealing them down. A boiler, fitted with a small wooden stand about 4 or 5 inches deep, is then placed on the stove and the jars put in with water surrounding them; this is brought to a temperature of 170° F., and kept at that heat for 30 minutes. If more convenient, the jars of pulp may be heated for that period in the oven. When the time is up, the jars are lifted out and placed on a folded wet cloth until cold. If this method is adopted and it is desired to remove the seeds, the pulp should be beaten well and then rubbed through a sieve, adding sugar if thought necessary.

Prepared by either of these methods, the pulp will keep indefinitely, and a jar may be opened for use at any time. A few of its uses are indicated in the following recipes:—

Melon and Passion Fruit Conserve.

6 lb. melon.
2 cups passion fruit pulp.
4½ lb. sugar.
3 pints water.

Peel, seed, and cut the melon into blocks. Sprinkle half the sugar through it and leave overnight. Next day, add the water and simmer till melon is cooked, then add the passion fruit pulp and the sugar, and when the latter is dissolved, boil the jam rapidly till it responds to the setting test.

Pear and Passion Fruit Jam.

6 lb. pears (Keiffer preferably).
4½ lb. sugar.
1 cup passion fruit pulp.
1 pint water.

Peel and core the pears and cut them into slices. Beat the passion fruit pulp a little to loosen the seeds, and then rub it through a sieve. Add this strained pulp and the water to the pears and simmer about 1½ hours, then add the sugar, and, when dissolved, boil till a good colour and consistency.

Passion Fruit, Lemon, and Apple Marmalade.

4 medium sized lemons.
1½ quarts water.
2 lb. cooking apples.
1½ cups passion fruit pulp.
Sugar to measure.

Halve the lemons and squeeze out the juice. Peel, core and slice the apples. Beat the passion fruit pulp a little and strain it. Put the apples into the preserving pan, with the strained lemon juice, passion fruit, water and the half pieces of lemon peel. Simmer until cooked, then remove

Passion fruit vines.

the pieces of lemon peel, measure the jam and put in an equal measure of sugar. Boil rapidly till it responds to setting test.

Passion Fruit Cream.

4 tablespoons white sugar.
1 tablespoon condensed milk.
½ cup passion fruit pulp.
1 cup fresh milk.

Mix the sugar and condensed milk together, add the passion fruit pulp, then add, very slowly, the fresh milk. When well mixed rub through a sieve to remove the seeds.

This preparation is very nice to serve with junket, custard, or stewed fruit, and for making fruit salads. It also makes a very nice frosting for cakes if mixed with icing sugar to the right consistency. In the latter case it is not necessary to separate the seeds.

Passion Fruit Butter.

1 small cup passion fruit pulp.
2 eggs.
1 teaspoon butter.
1 cup sugar.

Mix the sugar and butter together, add the passion fruit pulp, then the beaten eggs. Put all into a jar, stand in a saucepan of water and let the water boil for 20 minutes, when the butter should be a nice consistency.

Dried Peach and Passion Fruit Jam.

1 lb. dried peaches.
3 lb. sugar.
½ cup strained passion fruit pulp.

Soak the peaches in sufficient boiling water to cover, for about 10 minutes, adding a pinch of carbonate of soda; slip off the skins and put the peaches into fresh water and soak overnight. Next day, lightly drain them, add the passion fruit and sugar, and simmer till a good consistency.

Passion Fruit Jam.

Take any desired number of passions and scrub clean. Halve them and scoop out the pulp. Put one quarter of the shells on to boil in enough water to barely cover, and boil them till soft. Scrape out the soft inner pith and add it together with the water in which shells were boiled (strained) to the pulp. Measure the whole, and add an equal measure of sugar. Boil rapidly till a good consistency.

Passion Fruit and Banana Jam.

1 cup passion fruit pulp.
3 medium-sized bananas.
1 medium lemon.
Equal measure of sugar.

Make in the same way as passion fruit jam, but squeeze the juice from the lemon and add it to the passion pulp. Boil the lemon skin with the passion shells. Thinly slice the bananas.

Passion Fruit Canoes.

Make the little short-bread canoe shells in advance, and, when baked, keep them in a closed biscuit tin until required. For the passion fruit filling allow—

1 doz. passion fruit (or a good ½ cup preserved pulp).
3 Jonathan apples.
1 banana.
Juice of 1 lemon.
1 rounded teaspoon castor sugar.

Peel, core and grate the apple finely, mash the banana, and mix both with the strained lemon juice, sugar, and passion pulp. Pound these well together and put a little in each canoe shell. Spread a light coating of stiffly beaten white of egg over the fruit, and sprinkle well with castor sugar. Lightly brown the meringue in a cool oven.

Transfer of Offices

CONSEQUENT on a rearrangement of the offices of the Department of Agriculture the Horticultural Superintendent and most of his staff have now been transferred to the Head Office, Treasury Gardens. Those members of the staff engaged in fruit inspection and potato inspection at the wharves, Spencer-street, and the Fumigation Depot are, however, still stationed at 605 Flinders-street. Correspondence for the Horticultural Division should be addressed to the Department of Agriculture, Melbourne, C.2.

The Poultry Expert and the Dairy Produce Inspectors have also been transferred to the Head Office, and all letters should be addressed to them there.

In addition, the offices of the Wheat Growers' Relief Committee and the Fruit Growers' Relief Committee are now situated at 61 Spring-street, Melbourne, C.1, and all inquiries should be directed to that address.

Strangles in Horses

By W. M. Lerew, G.M.V.C., Veterinary Officer

STRANGLES is a highly infectious disease of horses, and is manifested by a catarrhal inflammation of the nasal passages and by enlargement and abscess formation of the adjacent lymph glands. It is due to the presence of a specific germ (*Streptococcus equi*), which may be found in the pus of the gland abscesses. It is regarded as a disease of young animals, as the greatest number of cases occur in horses between two and five years of age, although odd cases may appear at any age.

Accessory causes are teething, fatigue, chill, breaking in, and first stabling of young horses, all of which tend to lower the resistance.

The close stabling together of large numbers of horses, as on a sea voyage, or confining in an excessively warm, badly-ventilated stable, is the principal factor in the spread of the disease.

Swelling of the submaxillary lymph glands with the first appearance of catarrhal symptoms.
[After Hutyra and Marek.]

The germs abound in the nasal discharge, which will infect the drinking water and the feed, and as they may be found in the manure also, they will contaminate the bedding and prove a source of infection.

Operations, castration, &c., should not be performed on an animal while it is suffering from strangles, as the wound forms a favorable site for the growth of the germ, and may lead to the death of the patient. Healthy animals should not be operated on in premises where strangles are present.

The period of incubation is from three to eight days. One attack of strangles generally gives immunity against the disease, but occasionally an animal suffers a second attack.

Symptoms.

The first symptoms noticed are dullness, the head hanging, eyes partly closed, slight stiffness, and diminished appetite. On examination, the lining membrane of the nostrils will be found to be inflamed, and this may extend to the mouth and eyes as well. The membrane, at first dry, will later give out a watery exudate, and finally a thick opaque discharge of pus, which will vary in colour from white to yellow, or may be brown from exuded blood, or greenish from food materials. This discharge generally flows from both nostrils alike. In young animals it is more profuse than in old ones.

Early in the attack the two glands situated high up in the space between the lower jaws may become enlarged and painful, and the animal then stands with the head stiffly extended. The swellings soon coalesce, and form a firm, evenly rounded, hot and tender swelling. Later a small soft spot may be felt on the surface, and this is where the abscess will burst and the pus escape. The cavity will then gradually heal up, and the recovery of the animal follows. This is the usual course of events in a mild typical case, but serious complications often occur and may result in the death of the horse.

In more serious cases the trouble may spread from the nose to the throat, causing difficulty in swallowing and a return of ingested liquids

through the nose. The extent of the swelling may threaten suffocation. The disease may be spread to the windpipe by pus from an abscess, or by nasal secretions descending into the lungs, or by inhalation of food, and bronchitis may then ensue, followed by pneumonia. Secondary infection in strangles may lead to abscess formation in the abdominal glands. If the abscess bursts into the abdominal cavity death from peritonitis will occur, but in more favorable cases the abscess will burst into the bowel and recovery may follow.

Sometimes the disease attacks the skin, particularly of the face, head, and neck, and appears as small pustules or abscesses; these usually form round the lips, nose, and eyes, or may appear on spots rubbed by the harness.

Prevention.

Prevention of strangles is a difficult matter when the disease is present in the district, unless strict isolation of an animal is carried out, but certain precautions may be taken to lessen the risk. Keep young susceptible horses away from contact with strange horses; avoid public stables, and on no account allow animals to drink from public water troughs. Avoid hay or other fodder from an infected stable, and do not use harness that has been on affected horses. Before using an infected stable, thorough disinfection must be carried out.

Treatment.

In mild cases, only ordinary hygienic measures are required. Cleanliness, warmth, pure air, and nourishing easily digested food, with a plentiful supply of pure water, are the chief essentials. Rest is necessary, but exercise may be given in a sheltered yard or paddock in sunny weather. In warm weather it is advisable to keep the patient outdoors altogether instead of stabling him. If the weather is cool, the animal should be rugged. The most suitable food is grass, bran mashes, carrots, scalded oaten hay, and linseed tea. If the bowels are not acting properly two or three ounces of Glauber salts may be given daily in the drinking water.

Considerable relief will be given if the nostrils are sponged out with warm water and a little boracic acid, followed by inhalations of carbolic acid or creolin. The easiest method of giving inhalations is to fill a bucket with hot water and add a teaspoonful of the inhalant; put the bucket into a bran bag, and stand it on the ground, holding the upper end of the bag over the horse's nose. This may be continued till the steam ceases to rise from the bucket, and may be repeated several times daily. In some cases dry inhalations will be found of more benefit. For these, instead of the bucket of water, place a hot brick in the bag and pour on it a couple of teaspoonfuls of a mixture of equal parts of turpentine, eucalyptus oil, and Friar's balsam. Allow the patient to inhale the vapour three or four times daily.

Usually the affected animal is troubled with a cough, and this may be relieved by a mixture of camphor, 4 oz., extract of belladonna, 2 oz., and treacle, 1 lb., made into a paste or electuary, and applied to the back of the tongue by means of a flat strip of wood.

If the abscess is slow in coming to a point, it may be hastened by the application of linseed meal poultices to which a little creolin has been added. This may be kept in place by a many-tail bandage. If it is not convenient to apply poultices, stimulating treatment, such as rubbing with turpentine liniment, &c., or the application of a light blister, will help to bring the abscess to a head.

As soon as a soft spot can be detected a free incision with a sharp knife should be made to allow the pus to escape. If the abscess should burst before being opened, it is advisable to insert the knife and increase the size of the opening, so that the pus will have freer exit. Wash out the cavity with some antiseptic, such as a 2½ per cent. solution of creolin, or lysol (one tablespoonful to one pint of water), till the opening heals up. The fever usually subsides when the abscess has been drained. All that is required then is nursing and rest, and a complete recovery may be looked for. If any of the various complications of the disease set in, the skilled attention of a veterinary surgeon should be sought at once.

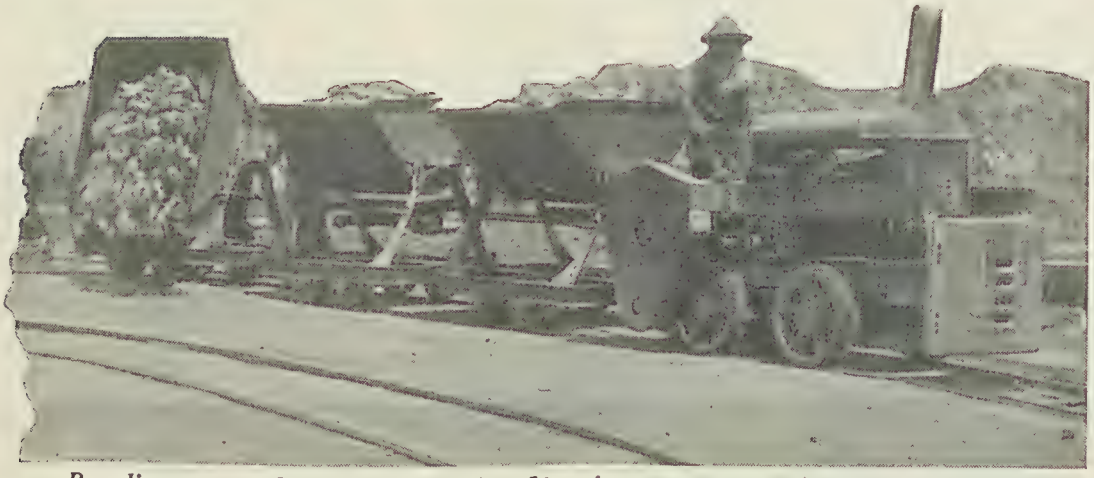
Vaccines.

Preventive and curative treatment may be carried out by a veterinary surgeon by the use of vaccines. This will prove specially valuable in the case of young thoroughbreds with important racing engagements ahead of them. Vaccination is a very wise precaution to take before shipping horses for a sea voyage.

The Fungicides Act 1935

Brands Registered

By W. C. Robertson, Chemist



Raw limestone rock ready for the kiln. Lime is used extensively in the manufacture of fungicides and insecticides.

THE *Fungicides Act* 1935 amends the previous Act of 1928, which was found to provide insufficient control over the sale of pest destroyers in Victoria.

The main amendments involve, firstly, provision for the compulsory registration of a distinguishing name or brand for every fungicide, insecticide, vermin destroyer, or weed destroyer. Secondly, the proclamation of new standards for the principal fungicides and insecticides (other standards may be prescribed and proclaimed when deemed necessary) and of a dilution standard for arsenical sheep and cattle dips.

Under the Act it is necessary for every wholesale dealer, which means any manufacturer, importer, or other person who is primarily responsible for placing any fungicide, insecticide, vermin destroyer or weed destroyer on the Victorian market, to make application to the Director of Agriculture on or before the last day of February (the 1st of April in 1936) in every year for the registration of "brands" for every fungicide, insecticide, vermin or weed destroyer in which he deals, together with particulars as to his name and place of business, the name of the manufacturer of the pest destroyer, and the percentages of the constituents which are declared to be active, contained in the fungicide, insecticide, vermin, or weed destroyer.

Where a standard is prescribed and is in force the guaranteed percentage of the active constituents, or the percentages (on dilution in the case of sheep dips) must comply with that standard.

The standards which have been prescribed and proclaimed (see Table I.) cover the commoner types of pest destroyer, but do not include crude, miscible, or emulsified mineral oils. Provision is made in the Act, however, whereby standards may be prescribed and proclaimed for oil sprays and other pest destroyers of lesser importance if it is deemed advisable.

The standardization of an insecticide, fungicide, sheep dip or weed destroyer (pest destroyers) is not based only on its effectiveness or killing efficiency, the matter of quality is also considered. For example, a brand of arsenate of lead, when used as a dust or spray, may contain sufficient arsenic oxide to have a high killing power and yet produce most harmful results, due to its content of water soluble arsenic compounds or excess acidity, therefore a limit is prescribed for its content of these substances.

In the list of over 300 brands of pest destroyers which have been registered (see Table II.) there are many for which no standards are prescribed. This does not necessarily lessen the value of the

unstandardized pest destroyer or increase the risk by its use for the purchaser.

Under the Act all registered brands of pest destroyers must have a guaranteed content of the constituents which are declared to be active. It follows therefore that the purchaser will be in the position of making his own comparisons when purchasing any of the principal pest destroyers on the market, relying on the chemist of the Department of Agriculture to determine per medium of inspection and chemical analyses whether all brands of pest destroyers which are registered are of the quality guaranteed. In this respect it should be noted that it is not compulsory for any wholesale dealer, when registering a brand for a pest destroyer under the Act, to divulge the formula or the complete analysis of the substance. All that is required to be guaranteed is the content of the constituents which are claimed to be active.

Should the purchaser of a parcel of pest destroyer have any doubts about its quality, and wish to have it tested *after accepting delivery*, the Act and its regulations provide the procedure to be adopted (Sect. 15, Regulation 4). However, in cases of this nature, as the necessary effective action is somewhat involved, it is advisable to seek the advice of the Inspector of Fungicides before coming to any decision.

Reference to the list of the brands of pest destroyers registered for the current year and shown in Table II. discloses little which can be regarded as new. For the most part the old time remedies which are based on the killing efficiency or deterring action of arsenic oxides and arsenates, basic copper salts or compounds, lime and sulphur, either singly or in physical admixture or chemical combination, are still pre-eminent. Tobacco and nicotine dusts or powders, and the concentrated nicotine sulphate appear to be increasing in popularity. The various oil sprays, including the more recent coal-tar oils, are particularly well represented, which is due, no doubt, to their effectiveness as ovicides and scalecides. The higher grades of mineral oil in dilute emulsion have an extended use in dual purpose spraying for which they are particularly well adapted because of their purity and wetting powers.

With regard to the more recent contact insecticides, such as rotenone and pyrethrum, we find the former very poorly represented in the list of brands, mainly as a vermin destroyer in the sheep dip section, while the latter is not mentioned at all. It is questionable whether the use of these insecticides in Australia will extend beyond the home garden and nursery, although they may prove of value as vermin destroyers.

It may be said that the list of weed destroyers is very small, particularly when the number of substances which have long been recognized for their power of weed eradication is considered. However, the deadly arsenical weed destroyer is well represented by a dozen different brands, and when considered with the various brands of

TABLE I.—STANDARDS OF INSECTICIDES, FUNGICIDES, ETC., PRESCRIBED AND PROCLAIMED—1936.

First Schedule.

Name of Fungicide.	Standard.
Bordeaux Mixture Paste or Powder	Shall be chemically prepared basic copper sulphate made by the addition of lime or calcium hydrate in excess to a solution of copper sulphate It shall contain not less than 12·5 per cent. of copper (Cu) calculated on the dry basis and it shall not contain any water soluble copper compound
Lime Sulphur Solutions	Shall not contain any sludge. Shall contain not less than 28 per cent. of total soluble sulphur, not less than 20 per cent. of polysulphide sulphur, and not more than 2·5 per cent. of thiosulphate sulphur, all calculated as percentage by weight in volume
Any copper compound or mixture containing copper sold prepared or offered for sale for the dry control or prevention of any fungus disease of cereals	(*a*) Shall contain not less than 50 per cent. of Copper (Cu) in the form of basic carbonate and/or basic sulphate or oxychloride (*b*) Shall contain not more than 0·25 per cent. of copper in a form soluble in water (*c*) Not more than 2½ per cent. of the material shall be retained on a standard 1 m.m. 200-mesh sieve when 10 grams of the material are shaken by hand for five minutes with 150 c.c. of water in a stoppered Erlenmeyer flask and sieved in a gentle stream of water poured from the flask or from a wash bottle
Caustic, burnt, fat, stone, or roche lime ..	Shall contain not less than 80 per cent. of available lime (CaO)

TABLE I.—STANDARDS OF INSECTICIDES, FUNGICIDES, ETC.—*continued.*

Second Schedule.

Name of Insecticide.	Standard.
Arsenate of Lead—Paste or Powder	Shall contain not less than 31 per cent. of arsenic pentoxide (As_2O_5) combined with lead oxide, and not more than 0·5 per cent. of water-soluble arsenic compounds (as As_2O_5), both calculated on the dry basis. Shall not contain more than 50 per cent. of water. The acidity (calculated as nitric acid) shall not exceed 0·2 per cent., calculated on the dry basis
Basic Lead Arsenate—Paste or Powder ..	Shall contain not more than 25 per cent. of arsenic pentoxide (As_2O_5) combined with lead oxide in the proportion of (As_2O_5) to lead oxide (PbO) of at least 1 : 3, and not more than 0·5 per cent. water-soluble arsenic compounds (as As_2O_5), both calculated on the dry basis, shall not contain more than 50 per cent. of water
Solutions of Nicotine or Nicotine Sulphate ..	Shall contain not less than 38 per cent. nicotine weight in weight
Tobacco Dust or Powder	Shall consist of disintegrated tobacco or tobacco waste and shall contain not less than 1 per cent. of nicotine
Nicotine Dusts	Shall consist of nicotine or a nicotine compound in an inert carrier and shall contain not less than 1 per cent. of nicotine.
Lime Sulphur Solutions	Shall not contain any sludge. Shall contain not less than 28 per cent. of total soluble sulphur, not less than 20 per cent. of polysulphide sulphur and not more than 2·5 per cent. of thio-sulphate sulphur, all calculated as percentage by weight in volume
Caustic, burnt, fat, stone, or roche lime ..	Shall contain not less than 80 per cent. of available lime (CaO)

Third Schedule.

Name of Vermin Destroyer.	Standard.
Sheep Dip (Arsenical)	Arsenical sheep dip when diluted with water in accordance with the instructions on the label for the purpose of dipping sheep shall not contain less than 0·20 per cent. and not more than 0·25 per cent. of arsenic calculated as As_2O_3. It shall not contain free caustic soda

Fourth Schedule.

Name of Weed Destroyer.	Standard.
Any substance sold or offered for sale as Weed Destroyer containing arsenic in any form or combination whatsoever	Shall contain not less than 20 per cent. arsenic (As_4)

chlorate destroyers which are registered, it must be admitted that effectiveness is well catered for in this section.

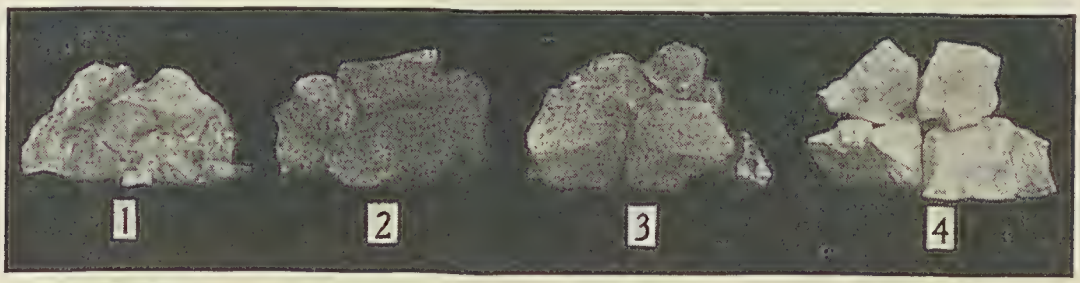
A word of warning is issued on the danger accompanying the careless use of the poisonous soluble arsenical weed destroyers. This chemical may be used on the farm for the purpose of killing scrub and useless timber, eradicating certain noxious weeds and plants or destroying vermin. All utensils used during the poisoning operation should be carefully cleansed by scrubbing with soap and water after use, and finally rinsing in several changes of water prior to being put away.

Stock should be carefully herded away from the danger zone for a period covering a heavy fall of rain and all drainage water from the treated area should be carefully and temporarily deflected from the dam or water course. Attention should be

paid also to the empty tin, drum, or package, and partly used containers should be boldly labelled in a permanent manner before being returned to shed or store-room. With these essential precautions, the risk attending the use of soluble arsenic as a weed (or vermin) destroyer is reduced to a minimum.

Sodium chlorate as a weed destroyer is non-poisonous, but its chemical composition is such that it assists combustion most energetically, and great care is necessary during and after its use. Clothes, when contaminated with the chemical, become highly inflammable on drying, and should be discarded or washed as soon as spraying is completed. This does not apply to calcium chlorate when it is diluted with calcium chloride, as is the case with "Weedex."

In conclusion, for the home or market garden, particularly in populous quarters, and even in the orchard, *drastic* treatment in the eradication of weeds is not recommended. In the majority of these cases there are many safer weed destroyers than either soluble arsenic or sodium chlorate by the use of which the accidental destruction of valuable plants or the contamination of soil is readily avoided, not to mention graver risks which attend the careless use of dangerous chemicals by those who are not familiar with their properties.



Samples of stone lime as supplied to the chemical trade. The figures denote purity (available lime).

TABLE II.—LIST OF FUNGICIDES, INSECTICIDES, VERMIN DESTROYERS, AND WEED DESTROYERS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE FUNGICIDES ACT 1935 (No. 4295), FOR THE YEAR 1936–37.

Distinguishing Name of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).				Manufacturer or Wholesale Dealer.
	Arsenic Pentoxide (As_2O_5) Calculated on the Dry Basis.		Acidity Calculated as Nitric Dry Basis.	Content of Water.	
	Total.	Water Soluble.			
Arsenate of Lead (Paste).	Minimum. %	Maximum. %	Maximum. %	Maximum. %	
Aero	31·5	·25	·2	50·0	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
Avery's	32·0	·50	·2	50·0	Avery's Garden Insecticide Co., 67 Burnley-street, Richmond
Bergers Mercury	31·0	·50	·2	50·0	Neptune Oil Co. Ltd., 532 Bourke-street, Melbourne
" " (Colloidal)	31·0	·50	·2	50·0	" " "
Blue Bell	31·0	·50	·2	50·0	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Elephant	31·0	·50	·2	50·0	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Lion	31·0	·50	·2	50·0	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Lunevale Lethalate (Collodial)	31·0	·04	·2	50·0	Brown and Dureau Ltd., 422 Collins-street, Melbourne
Vallo	32·0	·50	·2	50·0	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Woolworths	31·0	·50	·2	50·0	Woolworths Nurseries, South-road, Moorabbin
Tip Top	31·0	·50	·2	50·0	Law Somner Pty. Ltd., 21–23 Elizabeth-street, Melbourne

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Name of Insecticide and/or Fungicide.	Percentage of Declared Active Constituents.				Manufacturer or Wholesale Dealer.
	Arsenic Pentoxide (As_2O_5) Calculated on the Dry Basis.		Acidity Calculated as Nitric Dry Basis.	Content of Water.	
	Total.	Water Soluble.			
	Minimum. %	Maximum. %	Maximum. %	Maximum. %	
Arsenate of Lead (Powder).					
Aero	31·5	·25	·2	..	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
Avery's	32·0	·50	·2	..	Avery's Garden Insecticide Co., 67 Burnley-street, Richmond
Bergers Mercury	31·0	·50	·2	..	Neptune Oil Co. Ltd., 532 Bourke-street, Melbourne
Blue Bell	31·0	·50	·2	..	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Coopers Arsinette	31·0	·50	·2	..	F. R. Mellor, 440 Elizabeth-street, Melbourne
Elephant	31·0	·50	·2	..	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Lion	31·0	·50	·2	..	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Lunevale	32·74	·253	·2	..	Brown and Dureau Ltd., 422 Collins-street, Melbourne
Ortho Standard	31·0	·50	·2	..	H. C. Pannifex and Co. Pty. Ltd., 4 Dudley-street, Melbourne
Plane	31·0	·50	·2	..	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
Summit	32·0	·50	·2	..	T. E. Butler, 486 Collins-street, Melbourne
Vallo	32·0	·50	·2	..	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Tip Top	31·0	·50	·2	..	Law Somner Pty. Ltd., 21–23 Elizabeth-street, Melbourne
Calcium Arsenate.					
Avery's	40·0	..	..	..	Avery's Garden Insecticide Co., 67 Burnley-street, Richmond
Elephant	40·0	..	..	..	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Lion	40·0	..	..	..	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Vallo	40·0	..	..	..	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Tip Top	40·0	..	..	..	Law Somner Pty. Ltd., 21–23 Elizabeth-street, Melbourne

Distinguishing Name of Insecticide and/or Fungicide.	Percentage of Declared Active Constituents.		Manufacturer or Wholesale Dealer.
	Percentage Copper (Cu).	Percentage Copper (Cu) Water Soluble.	
Sulphate of Copper (Bluestone).			
Commonwealth	Copper (Cu) 25·0	..	Commonwealth Fertilisers and Chemicals Ltd., 65 William-street, Melbourne
Cresco	,, 25·0	..	Cresco Fertilisers Ltd., Geelong
Macclesfield (Blyths)	,, 24·0	..	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
,, (Jaques)	,, 24·0	..	Jaques Pty. Ltd., 31 Queen-street, Melbourne
,, (Neptune Oil Co.)	,, 25·0	..	Neptune Oil Co. Ltd., 532 Bourke-street Melbourne, C.1
Pannifex	,, 25·0	..	H. C. Pannifex and Co. Pty. Ltd., 4 Dudley-street, Melbourne
,, Instant	,, 25·0	..	,, ,, ,, ,, ,,
Vallo (Lump)	,, 25·0	..	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
,, (Snow Crystals)	,, 25·0	..	,, ,, ,, ,, ,,
,, (Powdered)	,, 25·0	..	,, ,, ,, ,, ,,
,, (Bordeaux Manufacture)	,, 25·0	..	,, ,, ,, ,, ,,
Lion	,, 25·0	..	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Neptune Snow	,, 25·0	..	Neptune Oil Co. Ltd., 532 Bourke-street, Melbourne
Fauldings	,, 24·5	..	F. H. Faulding and Co. Ltd., 123–25 Lonsdale-street, Melbourne

	Percentage Copper (Cu).	Percentage Copper (Cu) Water Soluble.	Percentage through 200-Mesh Sieve.	
Basic Copper Carbonate.				
Cresco	50·0	·01	98·5	Cresco Fertilisers Ltd., Geelong
Sickle	52·0	Nil	99·8	Commonwealth Fertilisers and Chemicals Ltd., 65 William-street, Melbourne
Smutol (Oxychloride)	52·0	Nil	99·8	,, ,, ,, ,, ,,
Vallo (Anti-Bunt)	50·0	·25	97·5	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Name of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).	Manufacturer or Wholesale Dealer.
Dry Bordeaux Mixture (Powder).		
Avery's	Copper (Cu) 12·50 %	Avery's Garden Insecticide Co., 67 Burnley-street, Richmond
Elephant	,, 20·00	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Lion	,, 12·50	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Sincos (Paste)	,, 16·00 (dry basis)	Bordeaux Chemical Co. Pty. Ltd., 4 Glenbrook-avenue, East Malvern
Vallo (Dry)	,, 12·50	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Ortho (Powdered)	,, 12·75	H. C. Pannifex and Co. Pty. Ltd., 4 Dudley-street, Melbourne
X.L.	,, 13·00	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
Tip Top	,, 12·50	Law Somner Pty. Ltd., 21–23 Elizabeth-street, Melbourne
Burgundy or Copper-Soda.		
Vallo Burgundy Mixture	Copper (Cu) 12·5 %	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Lion Sporocide	,, 12·5	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Neptune Copper Spray	,, 12·5	Neptune Oil Co. Ltd., 532 Bourke-street, Melbourne
Paris Green.		
Elephant	Arsenious Oxide (As_2O_3) 55·0 %	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Lion	,, ,, ,, 50·0	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Felton, Grimwade, and Duerdin's	,, ,, ,, 50·0	Felton, Grimwade, and Duerdin's Ltd., 342–6 Flinders-lane, Melbourne
Tip Top	,, ,, ,, 50·0	Law Somner Pty. Ltd., 21–23 Elizabeth-street, Melbourne
Fauldings	,, ,, ,, 60·0	F. H. Faulding and Co. Ltd., 123–25 Lonsdale-street, Melbourne
Miscellaneous.		
Yarra Cheshunt Compound	Copper (Cu) 5·0 %	J. Parsons and Co., 155 Yarra-street, Abbotsford
Fauldings (London Purple)	Arsenious Oxide (As_2O_3) 45·0	F. H. Faulding and Co. Ltd., 123–25 Lonsdale-street, Melbourne
Blue Bell Special Copper Mixture	Copper (Cu) 12·0	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Cooper's Bordinette	,, 12·7	F. R. Mellor, 440 Elizabeth-street, Melbourne
Elephant Special Copper Mixture	,, 12·0	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Coposil	,, 18·50 (3·50 per cent. zinc)	H. C. Pannifex and Co. Pty. Ltd., 4 Dudley-street, Melbourne
Lime.		
Neptune	Available Lime (CaO) 80 %	Neptune Oil Co, Ltd., 532 Bourke-street, Melbourne
Pannifex Bordeaux Rock	,, ,, ,, 80	Pannifex and Co. Pty. Ltd., 4 Dudley-street. Melbourne
Vallo Selected	,, ,, ,, 80	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Name of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).			Manufacturer or Wholesale Dealer.
	Thio-Sulphate Sulphur.	Poly-Sulphide Sulphur.	Total Soluble Sulphur.	
	Weight in Volume.			
Concentrated Lime-Sulphur (Solution).	%	%	%	
Avery's	2·5	20·0	28·0	Avery's Garden Insecticide Co., 67 Burnley-street, Richmond
Blue Bell	2·5	20·0	28·0	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Elephant	2·5	20·0	28·0	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Lion	2·5	20·0	28·0	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Neptune	2·5	20·0	28·0	Neptune Oil Co. Ltd., 532 Bourke-street, Melbourne
Pannifex	2·5	20·0	28·0	H. C. Pannifex and Co. Pty. Ltd., 4 Dudley-street, Melbourne
Vallo	2·5	20·0	28·0	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
X.L.	1·8	20·0	28·0	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
Tip Top	2·5	20·0	28·0	Law Somner Pty. Ltd., 21–23 Elizabeth-street, Melbourne

	Sulphur.	Calcium Hydrate.	
Lime and Sulphur (Dry Mix).	%	%	
Essen (No. 1)	62·0	..	Essen Chemical Bye Products Co. Pty. Ltd., 5 Melbourne-street, Murrumbeena
,, (No. 2)	46·0	..	,, ,, ,, ,, ,,
Pannifex	62·5	35·5	H. C. Pannifex and Co. Pty. Ltd., 4 Dudley-street, Melbourne
Vallo	64·0	35·6	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
X.L.	66·0	33·0	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne

Nicotine Sulphate.	%		
Avery's	Nicotine 40		Avery's Garden Insecticide Co., 67 Burnley-street, Richmond
Blue Bell	,, 38		Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Cooper's	,, 40		F. R. Mellor, 440 Elizabeth-street, Melbourne
Elephant	,, 38		Jaques Pty. Ltd., 31 Queen-street, Melbourne
Lion	,, 38		Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Pannifex	,, 40		H. C. Pannifex and Co. Pty. Ltd., 4 Dudley-street, Melbourne
Plane	,, 40		N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
Sigma	,, 38		Sigma Co. Ltd., 562–6 Little Bourke-street, Melbourne
Triumph	,, 40		F. R. Mellor, 440 Elizabeth-street, Melbourne
Vallo	,, 40		Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Woolworths	,, 40		Woolworth Nurseries, South-road, Moorabbin
Tip Top (Black Leaf 40)	,, 38		Law Somner Pty. Ltd., 21–23 Elizabeth-street, Melbourne
Black Leaf 40 (P.D.S.)	,, 40		Producers Co-operative Distributing Society Ltd., 180 Franklin-street, Melbourne
,, ,, ,, (Neptune Oil Co. Ltd.)	,, 40		Neptune Oil Co. Ltd., 532 Bourke-street, Melbourne

Tar Distillate.	%		
Cooper's Ovicide	Tar Oils 48 Phenols 10 Mineral Oil 20		F. R. Mellor, 440 Elizabeth-street, Melbourne
Vallo Ovicidal Wash	Emulsifiable Oils 89		Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
I.C.I.	Tar Distillate 70		Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
,, (No. 2)	,, ,, 35 Mineral Oil 35		,, ,, ,, ,, ,,

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Name of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).	Manufacturer or Wholesale Dealer.
Benzol Emulsion.		
Avery's	Benzol 30%	Avery's Garden Insecticide Co., 67 Burnley-street, Richmond
Vallo	" 30	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Prepared White Oil or Emulsion.		
Avery's	White Mineral Oil 60·0%	Avery's Garden Insecticide Co., 67 Burnley-street, Richmond
Atlantic	" " " 86·0	Atlantic Union Oil Co. Ltd., 396 Collins-street, Melbourne
Blue Bell	" " " 82·0	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Cooper's Alboleum	" " " 80·0	F. R. Mellor, 440 Elizabeth-street, Melbourne
Elephant	" " " 82·0	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Gargoyle	" " " 82·5	Vacuum Oil Co. Pty. Ltd., 29 Market-street, Melbourne
Kleenup	" " " 83·0	H. C. Pannifex and Co. Pty. Ltd., 4 Dudley-street, Melbourne
Lion	" " " 80·0	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Neptune	" " " 85·0	Neptune Oil Co. Ltd., 532 Bourke-street, Melbourne
" (Clarifol) Vallo	" " " 85·0	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
" (Prepared) Volck	" " " 60·0	H. C. Pannifex and Co. Pty. Ltd., 4 Dudley-street, Melbourne
White Spray	" " " 89·0	Shell Co. of Australia Ltd., 163 William-street, Melbourne
Woolworths	" " " 83·0	Woolworths Nurseries, South-road, Moorabbin
X.L.	" " " 85·0	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
Tip Top	" " " 80·0	Law Somner Pty. Ltd., 21–23 Elizabeth-street, Melbourne
Pale Spraying Oil.		
Gargoyle	Pale Mineral Oil 82·5%	Vacuum Oil Co. Pty. Ltd., 29 Market-street, Melbourne
Neptune Palsol	" " " 85·0	Neptune Oil Co. Ltd., 532 Bourke-street, Melbourne
Shell Pale-Spray	" " " 85·0	Shell Co. of Australia Ltd., 163 William-street, Melbourne
Shellicide D.	" " " 85·0	
Vallo	" " " 83·0	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
P.C.S.	" " " 85·0	Shell Co. of Australia Ltd., 163 William-street, Melbourne
Red Spraying Oil.		
Avery's	Red Mineral Oil 86·0%	Avery's Garden Insecticide Co., 67 Burnley-street, Richmond
Atlantic	" " " 89·0	Atlantic Union Oil Co. Ltd., 396 Collins-street, Melbourne
Blue Bell (Prepared)	" " " 85·0	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Elephant (Prepared)	" " " 85·0	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Gargoyle	" " " 85·0	Vacuum Oil Co. Pty. Ltd., 29 Market-street, Melbourne
Lion (Prepared)	" " " 80·0	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Neptune "A"	" " " 85·0	Neptune Oil Co. Ltd., 532 Bourke-street, Melbourne
" "C"	" " " 70·0	
Shell Red Spray	" " " 85·0	Shell Co. of Australia Ltd., 163 William-street, Melbourne
" "C" Tip Top (Prepared)	" " " 70·0	
" " "	" " " 80·0	Law Somner Pty. Ltd., 21–23 Elizabeth-street, Melbourne
Vallo	" " " 86·0	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
X.L. (Prepared)	" " " 80·0	Ramsay and Treganowan Ltd., 469–477 Latrobe-street Melbourne
Crude Spraying Oil.		
Neptune	Mineral Oil 85·0%	Neptune Oil Co. Ltd., 532 Bourke-street, Melbourne
Vacuum (Prepared)	" " 90·0	Vacuum Oil Co. Pty. Ltd., 29 Market-street, Melbourne
X.L. (Prepared)	" " 80·0	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
"	" " 100·	" " " " "

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Name of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).	Manufacturer or Wholesale Dealer.
Sulphur.		
Commonwealth (Dusting)	Sulphur 90·0 %	Commonwealth Fertilisers and Chemicals Ltd., 65 William-street, Melbourne
,, (Powdered)	,, 99·5 %	,, ,, ,, ,, ,,
,, (Atomic Dusting)	,, 90·0 %	,, ,, ,, ,, ,,
,, (Atomic)	,, 99·5 %	,, ,, ,, ,, ,,
Cresco (Dusting)	,, 89·4 %	Cresco Fertilisers Ltd., Geelong
,, (Atomic)	,, 99·5 %	,, ,,
Flotox (Wettable)	,, 98·0 %	H. C. Pannifex and Co. Pty. Ltd., 4 Dudley-street, Melbourne
Lion (Atomic)	,, 95·0 %	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Neptune (Powdered)	,, 99·0 %	Neptune Oil Co. Ltd., 532 Bourke-street, Melbourne
Vallo (Powdered)	,, 99·5 %	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
,, (Dusting)	,, 90·0 %	,, ,, ,, ,, ,,
,, (Wettable)	,, 98·0 %	,, ,, ,, ,, ,,
,, (Colloidal)	,, 50·0 %	,, ,, ,, ,, ,,
Cooper's (Colloidal)	,, 50·0 %	F. R. Mellor, 440 Elizabeth-street, Melbourne
Plane (Dusting)	,, 90·0 %	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
Ramtre (Dust No. 39)	,, 90·0 %	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
X.L. (Atomic)	,, 75·0 %	,, ,, ,, ,, ,,
Arsenic (Oxides).		
Vallo (White)	Arsenic (As_4) 75·37 %; (As_2O_3) 99·40 %	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
,, (Pentoxide)	Arsenic Pentoxide (As_2O_5) 83·00 %	,, ,, ,, ,, ,,
Felton, Grimwade, and Duerdins (White)	Arsenic (As_4) 74·20 %; (As_2O_3) 98·00 %	Felton, Grimwade, and Duerdins Ltd., 342–6 Flinders-lane, Melbourne
Fauldings (White)	Arsenic (As_2O_3) 98·00 %	F. H. Faulding and Co. Ltd., 123–25 Lonsdale-street, Melbourne
Miscellaneous.		
Vallo (Orchard Tree Bands)	Beta-Naphthol 20·00 %	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Tuberol	Stearoptenes and Oleoptenes 70·00	H. C. Pannifex and Co. Pty. Ltd., 4 Dudley-street, Melbourne
Pannifex Worm Killer	Sodium Hypochlorite 6·50	,, ,, ,, ,, ,,
,, Harlequin Bug Killer	Mineral Oil 10·00; Stearoptenes and Oleoptenes 10·00	,, ,, ,, ,, ,,
Shirlan "R.A."	Salicylanilide 8·40	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
,, "A.G."	,, 25·00	,, ,, ,, ,, ,,
Agrosan "G."	Mercury 1·40	,, ,, ,, ,, ,,
Sickle Carbon Bi-Sulphide	Carbon Bi-Sulphide 99·00	Commonwealth Fertilisers and Chemicals Ltd., 65 William-street, Melbourne
,, Formalin	Formaldehyde 38·00	,, ,, ,, ,, ,,
Faulding's Formalin	,, 37·00	F. H. Faulding and Co. Ltd., 123–25 Lonsdale-street, Melbourne
Felton, Grimwade, and Duerdins' Formalin	,, 38·00	Felton, Grimwade, and Duerdins Ltd., 342–6 Flinders-lane, Melbourne
Pannifex "No-damp-off"	Formalin 15·00	H. C. Pannifex and Co. Pty. Ltd., 4 Dudley-street, Melbourne
Champion Manurial Insecticide and Fungicide	Naphthalene 10·00; Stearoptenes and Oleoptenes 3·00; Tar Acids 1·00; Sulphur 3·00; Copper ·60; Phenol 4·30	,, ,, ,, ,, ,,
Kill-A-Mite Manurial Insecticide	Naphthalene 4·30; Hydrocarbon oils 12·85	Kill-a-Mite Co., 67–75 Roden-street, West Melbourne
Cooper's Apterite	Naphthalene 18·00	F. R. Mellor, 440 Elizabeth-street, Melbourne
,, Soil Sterilizer	Tar Acids 44·00; Neutral Tar Oils 29·00	,, ,, ,, ,, ,,
Nodew	Sulphur 30·00; Potassium Carbonate 60·00	E. H. Page, 218–220 High-street, Malvern
Ideal Slug and Snail Exterminator	Arsenic (As_2O_3) 1·89; Brunswick Green 16·0	,, ,, ,, ,, ,,
Anti-pestick	Nicotine 20·00	,, ,, ,, ,, ,,
Tip Top Kill-all	,, ·12	Law Somner Pty. Ltd., 21–23 Elizabeth-street, Melbourne
Clensel	Oil of Citronella 2·00; Ammonia 2·30; Potash Soap 60·00	Bruce Anderson, 15 Loch-street, Camberwell
B.M.I. Compost Spray	Mineral Oil 80·00	British Mushroom Industry, 94 Elizabeth-street, Melbourne
Shell Mushroom Spray	,, ,, 70·00	,, ,, ,, ,, ,,
Ceresan	Mercury 1·50	Dalgety and Co. Ltd., 461–71 Bourke-street, Melbourne

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Name of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).		Manufacturer or Wholesale Dealer.
Dusting Powders			
Edments Tobacco Dust	Nicotine	0·80	A. Edments Pty. Ltd., 309 Bourke-street, Melbourne
Avery's Pesto	"	0·80	Avery's Garden Insecticide Co., 67 Burnley-street, Richmond
G. J. Coles and Co. Tobacco Dust	"	0·80	G. J. Coles and Co. Ltd., 282 Little Collins-street, Melbourne
Pestend	"	0·75	W. D. and H. O. Wills (Aust.) Ltd., 411–423 Swanston-street, Melbourne
Pestide	"	0·75	" " " " "
Woolworth's Tobacco Dust	Nicotine	0·75	Woolworths Nurseries, South-road, Moorabbin
Plane Nicodust	"	2·50	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
" " No. 3	"	3·00	" " " " "
" " No. 5	"	5·00	" " " " "
Elephant Duston No. 1	"	4·00	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Nictar No. 2	"	3·00	H. L. Alkemade, 535 Little Lonsdale-street, Melbourne
Ramtre No. 4	"	2·00	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
" No. 5	"	3·00	" " " " "
" No. 6	"	4·00	" " " " "
Vallo No. 40	"	2·50	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Nictar No. 8	Arsenic Pentoxide (As_2O_5)	15·50	H. L. Alkemade, 535 Little Lonsdale-street, Melbourne
Plane "A.P." No. 1	" " "	6·20	N. N. McLean Pty. Ltd. 395 Queen-street, Melbourne
" "A.P." No. 25	" " "	7·75	" " " " "
" "A.P." No. 33	" " "	10·20	" " " " "
" "A.P." No. 50	" " "	15·50	" " " " "
Ramtre No. 17	" " "	8·00	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
" No. 19	" " "	16·00	" " " " "
Vallo "A.L." 30	" " "	9·60	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
" "A.L." 50	" " "	16·00	" " " " "
Nictar No. 10	Copper (Cu)	8·75	H. L. Alkemade, 535 Little Lonsdale-street, Melbourne
Plane Coppodust	"	8·75	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
Ramtre No. 14	"	8·00	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
Arresto	Sulphur	9·00	Law Somner Pty. Ltd., 21–23 Elizabeth-street, Melbourne
	Anhydrous Ferrous Sulphate	9·00	
Tip Top Grubbo	Arsenic Pentoxide	·40	" " " " "
	Hellebore	1·30	
	Nicotine	·10	
	Slaked Lime	75·00	

	Nicotine.	Arsenic Pentoxide (As_2O_5).	Copper (Cu).	Sulphur.	
	%	%	%	%	
Elephant Duston No. 2	1·2	5·00	..	..	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Nictar No. 3	2·0	15·50	..	..	H. L. Alkemade, 535 Little Lonsdale-street, Melbourne
" No. 5	2·0	7·75	..	..	" " " " "
Plane "A.P." No. 15N	2·0	4·65	..	..	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
" "A.P." No. 20N	2·0	6·20	..	..	" " " " "
" "A.P." No. 25N	2·0	7·75	..	..	" " " " "
" "A.P." No. 50N	2·0	15·50	..	..	" " " " "
" "A.P." No. 25	3·0	7·75	..	..	" " " " "
" "A.P." No. 50	3·0	15·50	..	..	" " " " "
Ramtre No. 9	2·0	8·00	..	..	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
Vallo "A.L.N."	2·0	8·00	..	..	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Ramtre No. 45	2·0	..	..	40·0	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
Plane "A.P." No. 2	..	4·65	..	75·0	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
" "A.P." No. 3	..	4·65	3·00	40·0	" " " " "
" Seed Bed	2·0	7·75	4·00	..	" " " " "
" Coppodust with Lead Arsenate	..	7·75	8·75	..	" " " " "
" Azurine No. 1	..	..	4·00	50·0	" " " " "
" " No. 2	..	..	7·00	40·0	" " " " "
" " No. 4	..	..	11·00	35·0	" " " " "
" " with Lead Arsenate	..	6·20	7·00	40·0	" " " " "
" Tomato No. 1	..	15·50	4·00	40·0	" " " " "
" " No. 2	..	7·75	4·00	40·0	" " " " "
" " No. 3	..	15·50	..	40·0	" " " " "

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Name of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).				Manufacturer or Wholesale Dealer.
	Nicotine.	Arsenic Pentoxide (As_2O_5).	Copper (Cu).	Sulphur.	
Dusting Powders—continued.					
Ramtre No. 21	..	6·00	6·00	30·0	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
Vallo Tomato and Vegetable No. 1	..	16·00	5·00	40·0	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
,, ,, ,, No. 2	..	8·00	5·00	40·0	,, ,, ,, ,, ,,
,, "A.L.B.N."	1·2	8·00	3·20	..	,, ,, ,, ,, ,,
,, "A.L.B."	..	8·00	3·20	..	,, ,, ,, ,, ,,
Plane Pea Mite No. 1	1·0	..	..	4·0 (Tar Oil)	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
,, Aphidust	2·5	..	..	4·0 (Tar Oil)	,, ,, ,, ,, ,,
Slugdie	·4	..	..	10·0 (Naphthalene)	Avery's Garden Insecticide Co., 67 Burnley-street, Richmond
Nictar No. 1	2·5	..	..	5·0 (Refined Creosote)	H. L. Alkemade, 535 Little Lonsdale-street, Melbourne
Banexo "C." Grade	..	..	..	5·6 (Tar Oil)	David Walker, Waverley Lime Works, Lara
Cooper's Katakilla	..	..	..	3·0 (Tuba Toxin)	F. R. Mellor, 440 Elizabeth-street, Melbourne
,, Drymae	..	..	..	1·0 (Tuba Toxin)	,, ,, ,, ,, ,,
Blowfly Preparations.					
Allkon Blowfly Oil	Arsenic (As_2O_5) 1·43%; Cresol 14·00%; Phenol 1·00%; Tar Oils 20·00%; Eucalyptus Oil 10·00%; Mineral Oil 30·00%				Allkon Pty. Ltd., 34 Queen-street, Melbourne
Bio-Fli-Di	Naphthalene 7·50%; Benzol 13·70%; Sulphur ·80%; Cresylic Acid 8·40%				The Nightingale Supply Co. Ltd., Ingle-street, Port Melbourne
Cresco Blowfly Repellent and Healer	Glycerides of Boric Acid 65·00%; Methylated Ethyl Alcohol 35·00%				Cresco Fertilisers Ltd., Geelong
Defiance Blowfly Oil	Petroleum Oils 83·00%; Coal Tar Derivatives 14·00%; Essential Oils 3·00%				The Shell Co. of Australia Ltd., 163 William-street, Melbourne
Immunol Blowfly Dressing	Arsenic (As_2O_5) 1·43%; Cresol 14·00%; Phenol 1·00%; Tar Oils 20·00%; Eucalyptus Oil 10·00%; Mineral Oil 30·00%				Hart and Co. Pty. Ltd., 84 Whiteman-street, South Melbourne
Neptune Blowfly Oil	Petroleum Oil 83·00%; Coal Tar Derivatives 14·00%; Essential Oils 3·00%				Neptune Oil Co. Ltd., 532 Bourke-street, Melbourne
Miscellaneous.					
Vallo Arsenate of Soda (for treatment of hides)	Arsenic Pentoxide (As_2O_5) 63·00%				Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Cresco Itch Fluid	Cresols and Phenol 40·00%; Glycerol 8·50%; Sulphur (as Sulphide) 14·70%				Cresco Fertilisers Ltd., Geelong
Younghusband's Weevil Killer	Arsenic Pentoxide (As_2O_5) 63·00%				Younghusband Ltd., 94–96 King-street, Melbourne
Hygienol Spray	Paradichlor-Benzene 4·30%; Cresylic Acid 10·30%				The Nightingale Supply Co. Ltd., Ingle-street, Port Melbourne
Cooper's Powder Worm Killer	Saponaceous Vegetable Matter 33·33%				F. R. Mellor, 440 Elizabeth-street, Melbourne
Allkon Sulphur Disinfectant	Cresol 44·00%; Sulphur 8·60%				Allkon Pty. Ltd., 34 Queen-street, Melbourne
Immunol Sulphur Antiseptic	Cresol 44·00%; Sulphur 8·60%				Hart and Co. Pty. Ltd., 84 Whiteman-street, South Melbourne
Faulding's Anti-weevil Compound	Arsenic (As_2O_5) 50·00%				F. H. Faulding and Co. Ltd., 123–25 Lonsdale-street, Melbourne

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Name of Vermin Destroyer (Dip).	Percentage of Declared Active Constituent(s).	Manufacturer or Wholesale Dealer.
Sheep and Cattle Dips (Arsenical).		
Cooper's Powder	Conforms with Standard	New Zealand Loan and Mercantile Agency Co. Ltd., 538 Collins-street, Melbourne
Cresco Fluid	" " "	Cresco Fertilisers Ltd., Geelong
Edward's Powder	" " "	Primary Producers Chemicals Pty. Ltd., 430 Little Collins-street, Melbourne
Little's Powder	" " "	Wilcox Mofflin Ltd., 499 Little Collins-street, Melbourne
Quibell's Powder	" " "	Dalgety and Co. Ltd., 461–471 Bourke-street, Melbourne
Vacdip	" " "	Vacuum Oil Co. Pty. Ltd., 29 Market-street, Melbourne
Sickle Powder	" " "	Commonwealth Fertilisers and Chemicals Ltd., 65 William-street, Melbourne
Thomas' Liquid	" " "	The Thomas Sheep and Cattle Dips Pty. Ltd., 47 Adam-street, Burnley
Vallo	" " "	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Atlantic	" " "	Atlantic Union Oil Co. Ltd., 396 Collins-street, Melbourne
Miscellaneous Dips.		
Allkon	Arsenic (As_2O_3) 41·80%; Sulphur as Sulphide 1·40%; Derris Ext. (Crude) 4·60%	Allkon Pty. Ltd., 34 Queen-street, Melbourne
Cooper's Quickacting Powder	Arsenic (As_2O_3) 22·00%; Rotenone ·70%	New Zealand Loan and Mercantile Agency Co. Ltd., 538 Collins-street, Melbourne
" Milk Oil Fluid	Phenol and Cresol 18·00%	" " " " "
Hart's Immunol Fluid	Arsenic (As_2O_3) 20·00%; Cresol 32·00%	Hart and Co. Pty. Ltd., 84 Whiteman-street, South Melbourne
" " Super	Arsenic (As_2O_3) 22·40%; Cresol 30·70%; Oleo-resin (Derris) ·74%	" " " " "
Kymac	Cresols 58·00%; Rotenone 1·34%	Younghusband Ltd., 94–96 King-street, Melbourne
Little's Liquid	Arsenic (As_2O_3) 12·20%; Tar Acids 13·00%	Wilcox Mofflin Ltd., 499 Little Collins-street, Melbourne
" "	" " 19·00%	" " " " "
Quibell's Liquid	" " 18·00%	Dalgety and Co. Ltd., 461–471 Bourke-street, Melbourne
Ramtre Liquid	Arsenic (As_2O_3) 20·00%; Cresol 32·00%	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
Vallo Fluid	Tar Acids 20·00%	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Estates' Special Fluid	Arsenic (As_2O_3) 22·40%; Cresol 30·70%; Oleo-resin (Derris) ·74%	Australian Estates and Mortgage Co. Ltd., 114 William-street, Melbourne
" Cresol Arsenical	Arsenic (As_2O_3) 20·00%; Cresol 32·00%	" " " " "

Distinguishing Name of Weed Destroyer.	Percentage of Declared Active Constituent(s).	Manufacturer or Wholesale Dealer.
Weed Destroyers (Non-poisonous).		
Cresco Sodium Chlorate	Sodium Chlorate 98·0%	Cresco Fertilisers Ltd., Geelong
Felton, Grimwade, and Duerdins Sodium Chlorate	" " 99·7%	Felton, Grimwade, and Duerdins Ltd., 342–6 Flinders-lane, Melbourne
X.L. Sodium Chlorate	" " 99·5%	Ramsay and Treganowan Ltd., 469–477 Latrobe-street, Melbourne
Weedex	Calcium Chlorate 22·0%; " Chloride 71·0%	Commonwealth Fertilisers and Chemicals Ltd., 65 William-street, Melbourne
Fauldings	Sodium Chlorate 99·0%	F. H. Faulding and Co. Ltd., 123–25 Lonsdale-street, Melbourne
Weed Destroyers (Poisonous).		
Avery's	Arsenic (As_4) 60·6%	Avery's Garden Insecticide Co., 67 Burnley-street, Richmond
Bell's Dandy Blue Weed Killer	" " 55·0%	Rocke, Tompsitt, and Co. Pty. Ltd., 292–298 Flinders-street, Melbourne
Cooper's Weedicide*	" " 27·0%	F. R. Mellor, 440 Elizabeth-street, Melbourne
Edwards*	" " 20·0%	Primary Producers Chemicals Pty. Ltd., 430 Little Collins-street, Melbourne
Elephant	" " 60·6%	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Globe	" " 59·0%	Rocke, Tompsitt, and Co. Pty. Ltd., 292–298 Flinders-street, Melbourne
" Weed and Scrub*	" " 20·0%	" " " " "
Vallo Weed, Scrub, and Tree	" " 60·6%	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
" Arzeen	" " 60·6%	" " " " "
" Liquid Arzeen*	" " 36·3%	" " " " "
Hardy's Weed Killer*	" " 20·0%	Hardy's Weed Killer Pty. Ltd., 422 Collins-street, Melbourne

* In liquid form.

Orchard and Garden Notes

By Edward E. Pescott, F.L.S.

The Flower Garden.

THE increasing popularity of the iris family demands some consideration in these notes. It is now too late for the planting of the bulbs of the Spanish and English irises; they are very lovely in the blue shades, and the bronze-coloured variety known as Thunderbolt is always sought for.

Flag irises may still be planted. The thick creeping stem of plants of this family, being a Rhizome, should not be covered with soil; the roots come from the underside of the stem.

Flag irises are flowers of the sun, and never blossom successfully in shade, or even in partial shade. The soil should be well drained, and the plants revel in an abundant supply of lime. The presence of clay, too, in the soil is an advantage and they thrive well on a clay bank, or even on a raised rock work.

When Iris Stylosa, the mauve-flowered winter iris, has finished blooming, the plants may be lifted and the clumps broken up if necessary. In lifting, the foliage may all be cut hard back, and the plants given a good dressing of lime.

It is not yet too late to plant out shrubs and trees in the garden. Some good soil, with old manure or leaf mould added, should be worked into the bottom of the hole before planting. This is to encourage the downward trend of the roots.

The Vegetable Garden.

Sowings of green peas may now be made. Peas like a very good soil, without any clay and with a good supply of humus. Old animal manure or garden litter may be worked into the soil before sowing.

The seed should not be soaked; it will very quickly absorb moisture from a damp soil. It is advisable to dust the seeds with lime in the trench, before covering with soil, as apart from the fact that peas are lovers of lime it checks the activity of soil pests. Shallow sowing of seed is important; it must never be buried deeply.

Iris Stylosa.

Yorkshire Hero has been, for a long time, very popular. It is a good cropper and an excellent main crop pea. It has been largely replaced by Greenfeast, a variety reputed to be more productive, with larger pods. A third variety is Melbourne Market. This is a very fast grower, germinating much more quickly than Greenfeast. It is somewhat similar to Yorkshire Hero, but does not stool out so freely. It is taller growing than the others, and requires staking in the home garden. Melbourne Market has broader pods than those of Greenfeast and is very productive.

Seeds of broad beans may now be sown under similar conditions to those of peas.

Seeds of tomatoes may be sown under glass, for transplanting later.

The Orchard.

It is necessary now to attack the overwintering brood of Oriental peach moth in peach and nectarine trees. Some of the larvae winter in the branches, but the greater proportion settle in the soil near the base of the trunk. It has been found that regular stirring or cultivation of the soil considerably reduces the soil population.

As with the codling moth, large numbers may be caught in corrugated cardboard bandages. It is also thought that the use of bandages in winter favours the work of parasitic wasps.

The sterilization of all fruit cases used for the carriage of peaches is urgent; and indeed all forms of orchard hygiene, including clean cultivation, the cleaning of and the removal of bark from props, should be carried out.

The quince is a danger tree in Oriental peach moth-infested areas, and it would be wise to destroy all quince trees in peach-growing districts.

Peach trees should be sprayed just before the buds burst with Bordeaux mixture at the usual 6.4.40 strength to keep the leaf curl in check. A similar spray should be given to prunes and plums just at the swelling of the buds to check prune rust. A second spray at half strength will be necessary just after petal fall.

Re-Working of Fruit Trees

The Coming Campaign

THE limitation of the number of varieties of apples for export has necessitated the re-working of a very large number of trees in this State, in order that, as far as possible, all unsuitable varieties may be eliminated from commercial orchards. The re-working of course is not compulsory, as the fruit from many of the varieties will still be required for the local market.

The following are the names of the varieties now approved for export to any destination, and of those which may be sent overseas if permission be obtained. These latter may be regarded as still in the experimental stage; their names are indicated by an asterisk. It is quite possible that in future years the export will be forbidden of some of these, as well as of varieties about which there is at present no question :—

Alexander, Alfriston, Aromatic, Australian Beauty, Cleopatra, *Coleman, Cox's Orange Pippin, Crofton, Crow Egg, Delicious, Democrat, Dougherty, Duke of Clarence, Dunns, French Crab, Geeveston Fanny, Granny Smith, Jonathan, *Jubilee, *King Cole, King David, King Pippin, London Pippin, *McIntosh Red, Mobb's Codlin, Newtown Pippin, Nickajack, Pomme de Neige, Prince Alfred, Reinette du Canada, Ribston Pippin, Rokewood, Rome Beauty, Scarlett, Schroeder, Statesman, *Stayman, Stewart's, Stone Pippin, Sturmer, Tasman's Pride, *Wellington, *White Winter Pearmain, Worcester Pearmain, Yates.

In selecting the variety of apple that is desired in the change-over, it should be noted that :—

(*a*) it will be unwise for a grower to select too many of any one variety such as, say, Granny Smith;

(*b*) At the same time it will be well to bear in mind that such varieties as Jonathan, Granny Smith, Dunn's and others, are well known on the overseas market;

(*c*) varieties on the experimental or permit list should be selected only with caution and on advice, for, as already stated, it is possible that these, and probably others may be excluded later.

In order that the re-working of trees may be expedited, the Horticultural Division of the Department of Agriculture has arranged to set aside during the coming season a number of expert officers who will visit orchards in fruit-growing areas to assist and advise growers in re-working methods. Growers wishing advice and assistance should inform the Superintendent of Horticulture immediately, as it is hoped to complete the work this season, and therefore itineraries must be drawn up as soon as possible.

Further, all intending to take advantage of the scheme, should make arrangements for a stock of scions of the desired variety or varieties, so that they may be readily collected during the pruning season. If those who experience any difficulty in obtaining scions will communicate with this Department an endeavour will be made to obtain them, but no guarantee can be given that a full supply will be so collected.

* Experimental varieties.

Professional Papers

[This section is devoted to professional papers and articles of a scientific character.]

Clay-Pan and Buck-Shot Soils of a Goulburn Valley Area

By F. Penman, M.Sc., Assistant Research Chemist.

SUMMARY.—*Five soil types found on an area proposed as a site for a Horticultural Research Station at Tatura in the Goulburn Valley are described. The relation between occurrence of individual types of soil and contour on this allotment is discussed and certain outstanding features of the soils are noted, such as clay-pan and buckshot formation, the presence of bleached horizons in certain types and of light, deep subsoils in others. The effect is described of prolonged swamp conditions in relation to the properties of one soil type and of milder seasonal flooding on another type.*

A place is suggested for these soils among the solonized class of the great world group of alkaline soils, and the relation of these types to certain American soils is discussed. The representative character of the soils of the area, as typical of considerable expanses of country in the Goulburn Valley and Northern districts, is mentioned, and the suitability of the site for research purposes from this aspect is confirmed.

THE area with which the present report is concerned is Allotment 31, Parish of Toolamba, a holding of approximately 101 acres, situated 2 miles due east of Tatura, in the Goulburn Valley. The allotment is commanded by the Wilson Irrigation Channel, which forms its boundaries on the north and east.

This property was acquired in 1929 by the Victorian Government as the site for a Horticultural Research Station. In order to assist the planning of experimental work, the Horticultural Division of the Department of Agriculture requested a soil examination of the holding, and field work for this purpose was carried out in July, 1934, Mr. J. K. M. Skene, M. Agr. Sc. being actively associated with this phase of the investigation. This report is presented as a record of certain features of these soils which give them general interest.

The soils have developed from Goulburn Valley alluvium of late tertiary to recent age. The area has been cleared for many years; as far as can be ascertained it carried originally grey box (*Eucalyptus hemiphloia*), with the exception of a small area of black wattle (*Acacia decurrens*). The holding has a varied cropping history, including crops grown under irrigation, but in recent years the bulk of the area has been used for cereal cropping under natural rainfall. A small orchard planting remains at the north-east corner of the allotment.

Weather data, obtained from the Commonwealth Meteorologist, for the nearest centres for which such records are available, are shown in Table I., together with the numbers of years which contribute to the monthly averages.

The rainfall figures show the fairly good distribution throughout the year with well-defined winter maximum usual for the region. In accordance with the general trend in the north of the State, rainfall is heavier and temperatures lower than in the North-Central and Mallee districts.

General Description of Soil Types.

Five soil types have been defined on this allotment, as the result of soil survey work and laboratory investigation. Most of the soils show definitely silty character and fairly low proportions of calcium carbonate, features which distinguish Goulburn Valley soils in general, from those of the Mallee. Clay-pan structure, also characteristic of the Goulburn Valley region, is shown in most of the profiles, while there is frequent occurrence of ferruginous pisoliths in the form of "buckshot."

TABLE I.—METEOROLOGICAL DATA.

—	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Rainfall at Tatura (51 years) (inches) ..	1·11	1·00	1·29	1·37	1·73	2·35	1·75	1·85	1·70	1·75	1·25	1·31	18·46
Mean temperature at Shepparton (21 years) (°F.) ..	73·0	73·0	66·9	60·4	53·6	49·1	47·7	50·0	54·0	59·3	64·8	69·7	60·1

The soil types of the area have been designated Types A, B, C, D, and E. Discussion of the features of each type now proceeds by reference to representative profiles.

Type A.—The typical profile is as follows :—

0 to 5″—Light reddish-brown silty loam to silty clay loam.
5″ to 9″—Red-brown medium clay.
9″ to 24″—Red clay.
24″ to 45″—Light-brown clay, some limestone rubble.
45″ to 78″—Yellow-brown clay, with red brown and brown inclusions and limestone rubble.

Fig. 1.—Irrigating peach trees on soil similar to Type A.

This profile is listed in Table II. under Nos. 3361 to 3365, while a further representative profile is shown under Nos. 3340 to 3345.

A variant of this type occurs frequently, in which the red heavy clay layer constitutes the second horizon, without the intermediary red-brown medium clay. In these profiles, the surface soil is frequently deeper than the 5 inches shown above for the general type, averaging about 7 inches. This variant, occurring locally within the A type soils, has not been mapped separately, but is represented in the analytical work under Nos. 3373 and 3374 for the two uppermost horizons, the deeper zones being similar to those of the more typical A profiles.

The characteristic features of A profiles in general are the dominance of red and brown colorations, the silty character of the surface soil and the presence of heavy clays below the red clay-pan zone. Buckshot, while present to moderate extent in occasional bores, is of comparatively little importance in these soils.

Type B.—Profiles of this soil conform to the following type, represented by Nos. 3366 to 3372 in Table II. :—

0 to 3″—Brown-grey silty clay loam with buckshot.
3″ to 12″—Greyish-yellow silty loam with much buckshot. Greyish-white streaks are a feature of this horizon.
12″ to 24″—Light-brown clay, occasional white streaks in upper sections.
24″ to 33″—Yellow-brown clay, odd limestone.
33″ to 50″—Yellow-brown clay, little soft lime and rubble limestone.
50″ to 58″—Red and yellow-brown mottled clay.
58″ to 72″—Red and yellow-brown mottled medium clay, with lime (soft and rubble).

These soils are distinguished by the brown-grey colour of the surface, the absence of true red

Table II.—Mechanical Analyses and other Data.—Types A to D— (For Type E see Table III.)—Tatura.

Type A.

Number.	3361.	3362.	3363.	3364.	3365.	3340.	3341.	3342.	3343.	3344.	3345.	3373.	3374.	3339.
Depth (inch)	0–5	5–9	9–24	24–45	45–78	0–4	4–9	9–17	17–36	36–54	54–72	0–6	6–21	9–20
Gravel and stone	0·4	0·2	0·1	2·7	0·7	nil	nil	nil	nil	2·8	13·5	1·8	nil	nil
Coarse sand	1·7	0·9	0·5	0·9	0·4	0·5	0·3	0·1	..	..	..	2·1	1·0	0·5
Fine sand	28·7	21·0	9·8	14·7	19·0	33·0	21·4	14·5	..	..	..	37·4	19·3	21·2
Silt	39·8	32·8	25·6	24·0	20·0	39·0	33·8	24·8	..	..	..	33·1	20·9	22·9
Clay	25·0	40·0	58·6	55·3	55·8	21·7	40·3	53·6	..	..	..	22·8	53·5	49·8
Moisture	1·6	3·0	5·0	4·2	4·4	1·7	3·0	3·4	..	..	..	1·6	4·1	4·2
Loss on acid treatment	1·3	0·9	1·3	1·9	2·8	0·6	0·7	1·3	..	..	..	0·8	1·0	1·1
Loss on ignition	6·2	5·3	6·0	5·5	5·3	4·8	4·8	5·9	..	..	..	4·9	5·4	5·6
Calcium carbonate ($CaCO_3$)	0·00	0·00	0·09	0·46	0·51	0·01	0·00	0·00	0·17	0·99	0·23	0·00	0·00	0·00
Total salts	70	40	54	104	160	19	19	52	102	102	100	19	69	35
Chlorine	6	4	4	15	30	5	6	10	22	20	15	4	15	5
pH (Reaction)	7·9	8·2	8·6	8·8	8·9	7·8	7·0	8·0	8·6	8·7	8·9	7·0	7·1	7·7
Total nitrogen	112	..	..	..	..	101	..	..	..	..	..	90	..	..

Type B.

Number.	3366.	3367.	3368.	3369.	3370.	3371.	3372.
Depth (inch)	0–3	3–12	12–24	24–33	33–50	50–58	58–72
Gravel and stone	3·4	21·5	nil	nil	3·1	0·1	4·3
Coarse sand	2·0	2·3	1·1	1·0	0·5	0·2	0·1
Fine sand	25·7	25·8	18·3	16·2	16·0	17·9	26·0
Silt	40·4	42·2	27·1	26·2	22·9	23·6	24·5
Clay	27·0	25·8	48·6	51·0	53·6	53·3	43·5
Moisture	1·9	1·4	2·9	4·4	4·5	4·6	3·7
Loss on acid treatment	1·9	1·0	2·3	1·2	3·2	1·8	3·1
Loss on ignition	7·6	3·9	6·4	5·3	6·4	5·9	5·9
Calcium carbonate ($CaCO_3$)	0·02	0·00	0·01	0·01	1·66	0·33	1·85
Total salts	52	30	31	23	102	98	99
Chlorine	3	3	4	4	8	10	6
pH (Reaction)	8·1	8·2	8·4	8·8	8·8	8·9	8·9
Total nitrogen	140	49	..	..	..	..	..

Type C.

Number.	3350.	3351.	3352.	3353.	3354.	3355.	3356.	3357.	3358.	3359.	3360.	3346.	3347.	3348.	3349.
Depth (inch)	0–6	6–37	37–44	44–58	58–89	89–114	0–6	6–26	26–37	37–54	54–66	0–3	3–10	10–15	15–24
Gravel and stone	9·4	0·8	7·3	4·9	1·4	0·5	9·9	3·2	1·7	1·3	1·3	0·4	0·8	0·5	1·1
Coarse sand	1·8	0·5	0·9	0·9	0·8	0·4	2·3	1·1	0·8	1·3	1·6	0·5	0·4	0·3	0·3
Fine sand	30·2	15·3	24·4	24·4	28·9	32·8	37·3	22·4	25·7	28·9	30·3	16·8	10·1	8·9	8·8
Silt	35·3	23·5	21·9	17·0	19·7	24·1	30·6	18·8	19·9	20·4	17·4	23·5	19·3	18·9	20·1
Clay	26·1	56·3	48·0	53·5	45·5	38·6	27·1	53·9	49·9	45·4	48·2	49·9	62·5	64·8	62·7
Moisture	2·1	4·7	4·1	5·0	4·4	3·9	1·7	3·9	3·2	3·2	3·2	5·0	5·8	5·8	5·7
Loss on acid treatment	0·8	0·1	0·9	0·4	0·5	0·7	2·5	0·1	0·9	1·1	0·9	1·6	1·2	1·6	2·2
Loss on ignition	5·6	5·8	5·0	5·3	4·6	4·5	4·1	5·6	4·7	4·2	4·3	8·0	6·6	6·7	6·6
Calcium carbonate ($CaCO_3$)	0·00	0·03	0·32	0·08	0·03	0·25	0·01	0·01	0·00	0·00	0·01	0·00	0·01	0·05	0·96
Total salts	25	57	120	119	114	114	21	22	31	41	52	35	40	41	95
Chlorine	5	14	42	47	36	37	5	4	8	10	10	5	4	4	7
pH (Reaction)	7·3	6·3	8·6	8·5	8·7	8·6	7·8	5·9	6·7	8·1	8·1	7·1	8·1	8·6	8·7
Total nitrogen	84	..	..	..	..	..	62	..	..	..	..	132	45	..	..

Type D.

Number.	3320.	3321.	3322.	3323.	3324.	3325.	3326.	3327.	3328.	3329.	3334.	3335.	3336.	3337.	3338.
Depth (inch)	0–5	5–18	18–25	25–42	42–54	54–65	65–75	75–90	90–114	114–150	0–5	5–9	9–24	24–36	36–48
Gravel and stone	nil	nil	0·7	nil	4·8	1·2	0·9	nil	nil	nil	nil	nil	nil	nil	4·4
Coarse sand	7·2	4·2	3·2	1·6	0·6	0·9	1·7	1·8	1·1	3·7	0·9	0·9	0·2	0·9	0·7
Fine sand	51·1	34·2	37·7	35·1	26·9	28·8	37·9	38·6	40·8	36·4	46·6	39·8	26·2	34·8	32·2
Silt	24·7	18·5	19·8	29·3	40·6	27·8	23·0	19·6	12·6	23·9	31·3	28·6	19·5	33·0	36·1
Clay	14·9	39·1	34·4	30·2	26·7	39·4	34·0	36·4	40·1	33·8	16·4	27·4	49·3	28·5	26·5
Moisture	1·2	3·0	3·3	2·8	2·6	2·7	2·4	2·8	3·6	3·0	1·4	1·7	4·3	2·8	2·3
Loss on acid treatment	0·6	0·9	2·0	2·1	2·9	1·3	0·9	0·7	0·9	0·8	0·5	0·5	1·0	0·9	2·1
Loss on ignition	3·5	4·3	4·6	4·7	5·2	4·6	3·7	3·8	4·6	3·9	4·2	3·3	5·4	4·0	3·8
Calcium carbonate ($CaCO_3$)	0·01	0·12	1·20	1·42	2·41	0·70	0·40	0·04	0·02	0·03	0·00	0·00	0·01	0·15	1·18
Total salts	20	40	52	53	59	53	60	25	40	35	15	15	19	31	69
Chlorine	4	4	4	5	5	4	3	5	6	4	4	3	5	3	6
pH	8·0	8·0	8·4	8·7	8·6	8·6	8·7	8·7	8·4	8·6	7·7	7·2	7·5	8·4	8·7
Total nitrogen	73	..	..	..	..	..	..	..	..	..	94	..	..	..	..

In Tables II. and III. results are expressed on dried prepared samples, except in the case of "gravel and stone," which is shown as percentage field sample.

Results for total salts, chlorine, and total nitrogen are given as parts per 100,000 of soil.

Remaining figures, except pH, represent percentage prepared sample.

TABLE III.—MECHANICAL ANALYSIS AND OTHER DATA.—TATURA.

Type E.

Number.	3330.	3331.	3332.	3333.
Depth (inch)	0–8	8–26	26–46	46–52
Gravel and stone ..	nil	nil	nil	0·6
Coarse sand	4·1	2·0	3·5	0·9
Fine sand	55·4	36·7	56·8	33·8
Silt	24·1	17·7	16·8	35·6
Clay	14·0	40·2	19·8	23·6
Moisture	1·1	3·1	1·8	2·2
Loss on acid treatment ..	0·3	0·4	1·1	3·7
Loss on ignition	3·3	4·6	3·1	3·8
Calcium carbonate ($CaCO_3$)	0·00	0·00	0·08	0·53
Total salts	24	31	52	71
Chlorine	6	7	7	9
pH (Reaction)	7·6	7·1	8·4	8·5
Total nitrogen	69	..	..	..

colorations in the upper clay horizons, extensive occurrence of buckshot, especially in the two uppermost zones, and particularly by the bleached appearance of the sub-surface horizon.

Type C.—The typical profile, represented by Nos. 3356 to 3360, Table II., is as shown below, a second representative profile being given also under Nos. 3350 to 3355 :—

0 to 6″—Grey silty clay loam with buckshot, white streaks below surface.
6″ to 26″—Yellow clay with buckshot, especially in the section 6 inches to 9 inches.
26″ to 37″—Yellow clay.
37″ to 54″—Yellow medium clay with grey and red-brown mottlings, and odd limestone nodules.
54″ to 66″—Yellow-brown medium clay, with grey mottlings.

Deeper borings show that the last-named medium clay persists to about 7 ft. 6 in., being then succeeded by yellow-brown to light red-brown medium clay with occasional limestone rubble (see Nos. 3354 and 3355 as representative of deep subsoils).

A variant of Type C occurs in local areas, showing dark-grey to grey clay at the surface rapidly giving place below the surface to heavy clays similar to the subsoils of the general C type, but heavier in texture. Numbers 3346 to 3349 represent this type of soil, which is the heaviest on the Station. This variant has not been separated from the general C type in mapping because of its patchy occurrence, but it is found along the northern fringes of the areas of Type C more frequently than elsewhere.

The distinguishing features of Type C soils in general are the grey surface soil, usually in rather unattractive physical condition, the presence of notable amounts of buckshot, especially in the surface soil, white streaks below the surface, and definitely yellow clay subsoils. The colour of the upper clays is quite a strong yellow, approximating to olive-yellow under field conditions.

Type D.—Samples 3320 to 3329, of Table II., represent the typical profile for D soils, described as follows :—

0 to 5″—Light red-brown fine sandy loam.
5″ to 18″—Red to red-brown medium clay, odd lime.
18″ to 25″—Red to light-brown light clay, some soft lime.
25″ to 42″—Brown clay loam.
42″ to 54″—Brown silty loam with limestone rubble.
54″ to 65″—Grey-brown light clay with odd limestone rubble.
65″ to 75″—Brown light clay with odd limestone rubble.
75″ to 90″—Yellow-brown to red-brown light clay, some grey mottlings.
90″ to 114″—Red-brown light clay, some red and grey mottlings.
114″ to 150″—Light red-brown to grey-brown light clay.

The profile listed under Nos. 3334 to 3338 represents a variant of this type in which the

Fig. 2.—A peach orchard established on soil similar to Type D.

sub-surface horizon is a light-red clay loam, constituting an intermediary zone between the surface soil and the clay pan.

Type D soils, as a whole, are characterised by the warm reddish-brown colour and fine sandy loam texture of the surface soil, the dominance of reddish colorations in the upper horizons, and the presence of rather more lime, especially in the region of 3 feet to 5 feet, than is usual in the other soils of the area. The special feature of these soils, however, is the marked decrease in clay content below the red clay pan, giving in some cases horizons of silty light clay or even clay loam and silty loam as in the profile described above. This feature of definite decrease in clay proportion below the clay pan is the essential point of difference between Type A and Type D soils, because although the majority of the surface soils of the latter series tend to fine sandy loam type, some are of silty loam character as in Type A.

Type E.—A typical profile of this soil, represented by Nos. 3330 to 3333, in Table III., is as follows :—

0 to 8″—Red-brown fine sandy loam.
8″ to 26″—Red medium clay.
26″ to 46″—Yellow-brown fine sandy loam (micaceous).
46″ to 52″—Greenish-yellow micaceous silty loam with rubble limestone.

Deeper borings in this type of soil show that the silty loam horizon mentioned above rests on yellow-brown silty light clay, followed by greyish-yellow and red medium clay with nodular limestone to 63 inches, below which occurs yellow and grey mottled clay to 78 inches.

The close relation between Type D and Type E soil is evident, the difference lying in the much more striking texture change below the clay pan in the Type E soils. In addition, the surface soils of Type E are uniformly of fine sandy loam character. The Type E profile is thus the lightest of those encountered on the Station.

Physical Characters.

Mechanical analyses of representative profiles, carried out in accordance with the International Method, are given in Tables II. and III.

Gravel and stone is recorded as percentage of the field sample, and in these soils consists largely of limestone rubble and/or buckshot. The tables show that this soil fraction is unimportant for the upper horizons of Type A soils, with the exception of the surface soil No. 3373. The gravel (1.8 per cent.) in this case, as in the small proportions for soils 3361 to 3363, consists largely of buckshot, with some siliceous gravel, limestone rubble being of very rare occurrence in these horizons. The zone of lime accumulation in A soils is roughly 24 inches to 54 inches, the gravel and stone in samples 3364, 3365, and 3344 consisting largely of rubble lime to pea size, occasionally in the form of tubes and rods, associated with small proportions of buckshot. The deep subsoil No. 3345 is unusual in its high stone proportion, this being largely buckshot to the size of a large pea, well rounded, but often rather soft.

In Type B soils buckshot up to pea size in the surface and to rather larger size in the sub-surface accounts for the figures shown, the sub-surface sample having the very high proportion of 21.5 per cent. Much of this material was of hard black character, the remainder being red-brown in colour and considerably softer. Zones of lime accumulation are shown in this B profile below 33 inches, samples 3370 and 3372 containing isolated limestone rubble up to 1-in. diameter, this material being responsible for the proportions of stone noted in the tables.

In Type C soils the major concentration of buckshot is in the surface soil. The figures shown for profiles Nos. 3356 to 3360 and 3346 to 3349 are all accounted for by buckshot, as are those for the two uppermost horizons of profile Nos. 3350 to 3355. The amounts shown for the lower zones of this last profile consist of buckshot and limestone rubble in varying proportions.

Types D and E are free from gravel and stone, except for limestone rubble up to pea size, occurring below 18 inches (samples 3322, 3324 to 3326, and 3338). Buckshot virtually is absent from these soils.

Coarse Sand.—Field examination and the results given in Tables II. and III. show that coarse sand is of almost negligible importance in the mechanical constitution of these soils, except in the upper horizons of Types D and E. Even in these cases, however, the highest figure shown is 7·2 per cent. for a surface soil of Type D. In Types A, B, and C particularly, a proportion of the coarse sand usually consists of ferruginous grains, the remainder being quartz as a rule.

Fine Sand.—This fraction is of considerable importance throughout the series, especially in the upper horizons of Types A, B, and C, and in all zones of Types D and E. Values range from 8·8 to 56·8 per cent. over the whole series. In Types D and E, particularly the latter, considerable amounts of mica occur in the fine sand fraction, especially below the clay-pan.

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Silt.—The high values for this constituent shown in many of the analyses, especially for upper sections of Types A, B, and C, and certain subsoils of Types D and E, are in accord with the distinctive character of Goulburn Valley soils. Figures vary from 12.6 to 42.2 per cent. over the series.

Clay.—Comparatively rapid increase in clay at fairly shallow depth is the most striking feature in the texture profiles of these soils, giving rise to structures of clay-pan type. The "pan" character, i.e., marked differentiation between the clay-band and adjoining horizons, is most marked in Types D and E, but the clay concentration there is not as dense as in corresponding zones in the other types.

The general similarity in composition in the clay bands Nos. 3363, 3342, 3374, 3339, 3368, 3351, 3357, and, on a lower general level of clay content, Nos. 3321, 3336, and 3331, is evident from Tables II. and III. Clay percentages maintain high general values in the deeper subsoils of Types A, B, and C, particularly in the heavier variant of the last type where all three subsoils exceed 62 per cent. of clay.

The highest figure recorded for surface soil of Types D and E is 16·4 per cent. clay, while the A series surface samples average about 23 per cent. and Types B and C, excluding the heavy variant of the latter, show figures approximating to 27 per cent. for surface soil. The C soils and some of the B types appeared heavier in the field in surface samples than the analyses indicate, probably because of poor physical condition.

Chemical Analyses and Reaction Values.

Calcium Carbonate.—Rubble lime has been discussed under "stone and gravel" in the preceding section. All samples were analysed for calcium carbonate in the "fine earth" prepared sample and the results are listed in the Tables II. and III. The figures show that if soft lime is present at all, it is in very small amount, except in zones where rubble limestone is also present. An exception to this is in sample 3349 (Type C), where nearly 1 per cent. of soft lime is present, but no rubble limestone. The highest concentration of soft lime was that of 2·4 per cent. in one of the Type D subsoils.

Reaction (pH).—Reaction values reported in Tables II. and III. have been determined by the quinhydrone or the antimony electrode procedure using 1 : 2·5 soil-water suspensions, checked in some cases by colourimetric methods.

These values for the series cover the range pH 5·9 to 8·9, those for surface soils being between 7·0 and 8·0. Most of the variability in reaction, and all the lower values, occur in the upper horizons, most of the soils below the uppermost clay band having reactions between pH 8·4 and 8·9. The C profile Nos. 3356 to 3360, however, does not rise above pH 8·1. Lime is absent from this profile. The upper horizons Nos. 3330 and 3331 of Type E and Nos. 3334 to 3336 of Type D show definitely lower reactions than corresponding horizons in the D profile (Nos. 3320 to 3329), which is notably richer in lime. This last profile and that for Type B show generally high reaction, increasing with depth, no horizon being below pH 8·0. Several of the profiles examined show their lowest reaction in the second horizon, this effect being especially striking in the normal Type C profiles, where reaction values pH 5.9 and 6·3 are shown. In these last-named profiles this effect has particular significance in that comparatively low reaction is maintained to considerable depth, the 26-inch. to 37-inch. zone No. 3358 having the value pH 6·7. All other profiles have attained a value greater than pH 8.0 at this depth so that a very definite distinction prevails from this aspect between these Type C soils and the remainder of the series.

Replaceable Bases.—The results listed in Table IV. for replaceable bases in these soils have been obtained by the Hissink method—*vide* (8).

The figures for relative equivalent proportions of replaceable bases for the A, B, and D type profiles show the dominance of calcium in surface and sub-surface soil, with magnesium approaching it in magnitude, closely in the A profile. In the deeper subsoils, magnesium exceeds calcium, an effect fairly general in Victorian soils.

In all profiles the proportion of replaceable potash diminishes with increasing depth, while there is a notable increase in the proportion of sodium in the deep subsoil, but not to a degree approaching values frequently found in deep zones of Mallee soils.

Type C profile differs from the others in that magnesium exceeds lime in proportion of chemical equivalents even in surface soil, while in the clay band No. 3351 it shows marked dominance over lime, to the extent of almost 4 : 1 in chemical equivalents. Replaceable lime in this horizon stands at only 5.6 milli-equivalents per 100 gm. of International clay fraction. This, and low base figures generally, obviously are related to the unsaturation of this soil as shown by the pH value. In the Type B profile, the bleached horizon represented by No. 3367 has a low figure

TABLE IV.—REPLACEABLE BASES IN SOILS.

—	TYPE A.				TYPE B.				TYPE C.			TYPE D.
Number	3361.	3362.	3363.	3365.	3366.	3367.	3368.	3370.	3350.	3351.	3354.	3336.
Depth (inch)	0 to 5	5 to 9	9 to 24	45 to 78	0 to 3	3 to 12	12 to 24	33 to 50	0 to 6	6 to 37	58 to 80	9 to 24
Total base	14·5	15·6	24·5	25·7	17·4	12·2	20·3	22·7	10·9	18·4	22·5	18·0
Relative proportions—												
Calcium (Ca)	42	43	36	16	51	46	33	31	37	17	17	48
Magnesium (Mg)	40	41	47	57	31	37	54	50	45	66	61	41
Sodium (Na)	6	5	10	21	8	7	6	13	4	9	16	3
Potassium (K)	12	11	7	6	10	10	7	6	14	8	6	8

Total base signifies total of the four replaceable bases shown, as milli-equivalents per 100 gm. dry soil.
Relative proportions show relative equivalent proportions on the basis total base = 100.

for total base, while the comparable horizon No. 3350 in Type C stands even lower in this respect. This together with frequent flooding probably accounts for the poor physical condition of the surface soil of this type.

Total Nitrogen.—Values for total nitrogen as set out in Tables II. and III., are of the normal order for Goulburn Valley soils. The figures range from 62 to 140 parts per 100,000 of soil for surface samples, variations being related to some extent to texture differences and especially to the depths of sampling. In two profiles where the surface horizon is shallow and comparatively high results are noted for total nitrogen, figures for the underlying horizon are given and show the usual striking diminution below the surface.

Hydrochloric Acid Extract.—Results for phosphoric acid, potash, lime, and magnesia are set out in Table V. for surface soils of the major types. These figures, in their relatively low general level of phosphate and moderate lime and magnesia values, accord with typical Goulburn Valley analyses, the potash results tending to be rather higher than is usual in the soils of this region.

Comparison, in certain soils, of the bases extracted by hydrochloric acid with those in replaceable form shows that nearly all the lime in Types A and B surface soils is in replaceable form while only slightly more than half the "total" lime is in this form in Type C. For potash, on the average, only about one-seventh of the "total" is in replaceable form, but even this low proportion gives quite reasonable amount of potash in the replaceable, or relatively available, condition. In the case of magnesia rather more than one-third of the total base is in replaceable condition.

Soluble Salts.—The analyses for all samples for chlorine in the form of chloride and total soluble salts (conductimetric determination) are shown in Tables II. and III. High salt content is comparatively rare in Goulburn Valley soils. In the present series, total salts do not rise above 0.16 per cent., or chloride above 0.05 per cent. Types D and E profiles show quite low salt content throughout, the highest figures for total salts and chloride being 71 and 9 parts per 100,000 of soil respectively. The heavier types A, B, and C, show higher figures and greater variability. There is the usual well-defined rise of salt content in the subsoils as compared with the upper horizons, a sharp rise being coincident with the appearance of lime in most cases. The C profile Nos. 3356 to 3360 and the heavy variant Nos. 3346 to 3349 show low salt content, but the latter is a comparatively shallow profile, and at 15 inches to 24 inches is showing a sharp rising trend in salt content as compared with overlying horizons. The remaining C profile Nos. 3350 to 3355 shows special tendency to chloride concentration, while the B profile has low values for chloride throughout. The total salt figures are of the same general order in A and B profiles, and in the C profile just quoted.

Examination of soluble salt extracts gave results as shown in Table VI. These relative proportions of salt radicles are very similar to those given by soils of Northern Victoria

TABLE V.—CHEMICAL ANALYSIS OF SOILS.—TATURA.

(*Figures show Parts per* 100,000 *of Dry Soil.*)

—	TYPE A.		TYPE B.	TYPE C.		TYPE D.
	3361.	3340.	3366.	3350.	3356.	3320.
Phosphoric acid (P_2O_5) ..	74	86	77	102	64	64
Potash (K_2O) ..	386	478	603	545	415	356
Lime (CaO) ..	180	200	270	200	190	230
Magnesia (MgO) ..	300	334	312	236	272	228

TABLE VI.—ANALYSES OF SOLUBLE SALT EXTRACTS.—TATURA.

(*Figures Represent Parts per* 100,000 *of Dry Soil*).

Sample No.	Total Soluble Salts.	Chloride (Cl.)	Sulphate (SO_4).	Carbonate (CO_3).	Bicarbonate (HCO_3).
3326 ..	60	3	6	Nil	40
3345 ..	100	15	8	Nil	38
3352 ..	120	42	17	Nil	45
3365 ..	160	30	27	Nil	67

generally. With the lower amounts of total salts, bicarbonate is the dominant acid radicle, but as total salts increase, chloride, usually as sodium chloride, assumes increased importance, as does sulphate also in the present series.

The higher amounts of soluble salts present in some of the deeper sub-soils probably exert definite influence on the field properties of these soils. Soil water suspensions (1 : 2.5) of several sub-soils, Nos. 3352 to 3355 and 3365 in particular, showing fairly rapid flocculation and settling after shaking, although all contain clay to the order of 50 per cent. It is likely that some flocculating action prevails under field conditions.

Distribution of Soil Types.

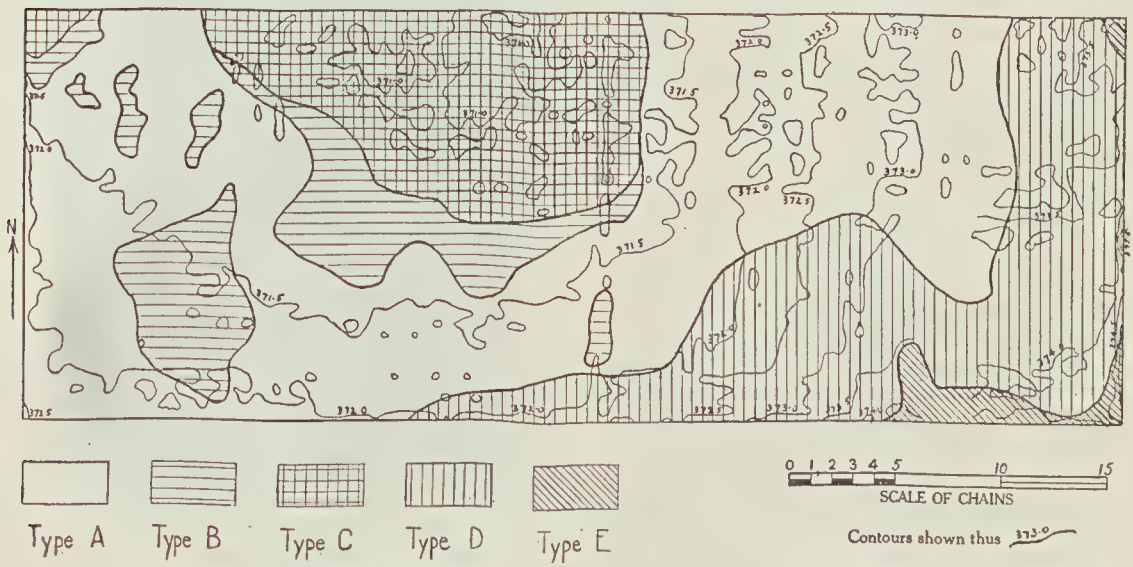
The manner in which the various soil types are distributed over the allotment, and the relation of this distribution to contour, are shown in Map 1. Type E is confined to the south-east fringe and the north-east corner of the allotment. Adjoining is a belt of Type D soil, which gives place to the major soil of the area, Type A. Type C occurs in two areas in the north-central to north-west portion of the Station, each occurrence being fringed to the south by Type B. This latter type occurs also as several isolated areas, chiefly in the western half of the allotment, surrounded by Type A.

The areas covered by each of the five types are approximately as follow:—

Type A—44.0 acres; Type B—10.9 acres; Type C—19.3 acres; Type D—24.7 acres; and Type E—2.0 acres.

On this allotment there is quite definite relation between contours and distribution of soil types. The highest point on the Station is on the eastern boundary where an elevation of 375.6 feet is recorded, while, apart from a dam in the middle of the area which shows a bed level of 370 feet, the lowest point is at 370·8 feet in the depression at the north. The maximum natural difference in level over the area is thus almost 5 feet. The contours show that the general slopes are to the north and to the west, resulting in a basin formation with which the occurrence of Type C is obviously connected. The boundaries of this soil type follow in a general way the 371.2 feet contour, so that in general areas below this level conform to this soil type.

Type B occurs on slightly higher ground fringing the occurrences of Type C and in local depressions surrounded by Type A. There is a general tendency for the northern occurrences of Type B to lie between the contour levels, 371·2 to 371·4



Map 1.—Distribution of soil types and the contours of the Tatura allotment.

Fig. 3.—A field photograph of Type B profile showing a depth of about 2 feet. Samples 3366 to 3372 are associated with this profile. Note bleached appearance of buckshot in second horizon.

feet, but, in the southerly isolated area, levels associated with this soil type may rise as high as 372.1 feet.

Types C and B are in fact definitely associated with swamp conditions, these being more severe and prolonged in character in the former case than the latter. The area occupied by Type C, and at least the south-westerly isolated area of Type B, formerly showed characteristic swamp vegetation of rushes, nut-grass, &c. It is known also that water lay in areas such as these, following heavy rains.

Type A covers the intermediate levels of the area as a whole, giving place to basins of Type B where local surface drainage is poor. There is thus no inconsistency in the variations noted above concerning the levels at which Type B occurs, the higher areas of this type being associated with *local* depressions in areas otherwise given over to Type A, while the lower occurrences are associated with the more *general* fall to the Type C basin.

Type E follows the high ground of the area, none of this type occurring below 373.2 feet, while the greater portion of Type D lies above 372 feet. The boundaries of both these types also tend to follow the general sweep of the contours.

Relations Between the Soil Types.

Continuity, in the sense of comparatively smooth gradation, is discernible in the relationships between the soil types of this area. This is based on the essential structural similarity in the major types due to common possession of the clay-pan feature. Type E is closely linked with Type D, as indicated early in this report. Type D, at its western fringe, shows such a sequence of variations towards increased siltiness of surface soil and/or increased clay content of the horizons underlying the red clay pan, that this boundary between Types D and A is less clearly defined than other demarcations made on the soil map of the area. Thus there is a link through Type D between Types E and A, and the latter is definitely related to Type B by distribution of occurrence and character of profile, which also serve to associate Types B and C.

These relationships suggest that a common eluviating process has been responsible for the major structural features of all the soil profiles. In view of the general nature of these soils and their climatic environment it would appear that this process has been of solonizing character, although the degree of sodium saturation is not marked. Mobility of salts, of lime and of clay under such a process would lead to formation of two broad groups of soils in the area under consideration, Types D and E as one group being developed from lighter alluvium than the remaining Types A, B and C. It is possible that Types B and C were differentiated from Type A only at a comparatively recent stage, local seasonal flooding having developed, in areas now covered by these types, certain "secondary" characters.

Clay-pan Formation.

With regard to the possibility of formation by eluviation of the type of pan profile described for these soils, the work of Brown, Rice and Byers (2) on clay-pan soils is of considerable interest. These

Fig. 4.—A field photograph of Type C showing a depth of about 12 inches. Samples 3350 to 3355 were taken from this location. Note bleached patches in surface horizons and upper zones of the clay.

workers describe a series of clay-pan profiles, chiefly in Nebraska, usually derived from Peorian loess of essentially silty character. Types D and E, showing, below the clay-pan, lighter horizons, which may be regarded as parent material for the overlying zones, have close structural relation with some of the profiles described by these authors. The remaining Types A, B and C, would not present the same scope for eluviation of parent material, assuming that the heavy deeper subsoils represent the parents. This latter consideration is complicated by the fact that in several parts of the Goulburn Valley there is evidence that the original alluvium was far from uniform with depth. Brown and his co-workers have found evidence of lateral erosion as a factor in the formation of a clay-pan structure on very heavy parent material consisting of lacustrine clay. It is possible that local erosion and local deposition of fine material has led to the type of differentiation found between the normal Type C profile and its heavier variant.

Again, Jenny and Smith (4), have discussed the colloid aspects involved in clay-pan formation. Assuming mobility of clay under solonization, it appears in the present soils that flocculation of this clay, when it reaches the zone of accumulation of soluble salts and of lime, is responsible for the formation of the pan. The possible influence of the original timber cover on this land is not overlooked, as it probably exerted considerable effect on water movement. Bray (1) considers that change in effectiveness of water movement in the soil is the cause of colloid deposition giving clay-pan. It is interesting to note that Bray's description deals with Cisne Silt Loam and that bleaching of the zone above the clay-pan and accumulation of iron concretions there have occurred in the profiles which he discusses. Several descriptions of clay-pan occurrence in silty types of soil in America and the finding of a similar position in the Goulburn Valley, and also at Bamawm, in the North-Central district of Victoria, suggests that soils of this character tend specially towards clay-pan development.

Significance of Buckshot.

The "secondary" features referred to in the above discussion, as developed in Types B or C, are the presence of buckshot, the development of a definitely acid horizon close to the surface, and the formation of a bleached horizon. The presence of buckshot in considerable quantity in certain of these soils, as previously described, is of great interest. It is reasonably definite that comparative development of these soils subsequent to the formation of the clay-pan feature has depended chiefly on the water incidence as determined by local topography, and on the permeability of the pan. Types D and E on the higher ground, and with less dense pans than the remaining types, are free from buckshot. Type A, on the intermediate levels with good surface drainage, but with a dense pan formation, usually shows a small proportion of buckshot of small size in the horizons overlying the pan, this feature being more marked where the clay-pan lies close to the surface. In Type B, with tendency to seasonal swamp conditions, very considerable amounts of ferruginous concretions have been developed, especially in the horizon immediately above the pan. In Type C, with more intense swamp conditions, the surface horizon, which is the only zone above the clay-pan, also shows quite high proportions of these pisoliths. In Types B and C many of these concretions attain considerable size, sometimes exceeding half an inch in diameter.

Fig. 5.—Showing a depth of about 15 in. of Type D profile. Samples 3320 to 3329 were taken from this profile. Note light texture of surface as compared with other photographs.

Brown et al (2) used the concept of lateral erosion particularly to explain the distribution of iron oxide in the profile derived from lacustrine clay. They suggest reduction of iron to the ferrous state by anaerobic fermentation during temporary swamp conditions and its removal by drainage above, not through, the clay-pan. With the modification that the bulk of the iron is not removed from the profile, but immobilized in the form of pisoliths, this explanation may be applied to the present soils. This effect presumably is due to restriction of lateral movement of water along the surface of the clay-pan, because of the basin formations in which Types B and C occur, i.e., an outfall is not available. Under these conditions, surface flow being possible only in the probably unusual event of a basin being filled with water, the iron held in solution would be deposited as ferric oxide on suitable nuclei when drier conditions supervened. Thus ferruginous concretions would form throughout the soil profile

to a depth depending on the maximum penetration of water. Obviously the maximum concentration of these pisoliths will be found in the zone most frequently subjected to alternations of water-logged and dry conditions, namely, the horizon immediately above the clay-pan. The observations made on Types B and C are in accordance with this idea.

It has been mentioned above that Bray (1) found ferruginous concretions under clay-pan conditions in Cisne Silt Loam. Their occurrence to limited degree has been noted also in the Bamawm soils of North-Central Victoria.

Distinction between Types B and C.

Following out the processes of development of these soils in accordance with the general theory outlined above, the difference now observed between Types B and C is due to the difference in water incidence upon the two types. In addition to the presence of ferruginous concretions in notable amount, the outstanding feature of Type B soil is the bleached appearance of the second horizon. The analyses show that, while this layer is bleached, it is also low in replaceable bases, indicating some destruction of the clay complex. The ashy appearance of this layer brings this type into a class similar to the "pseudopodsol" described by Brown and his co-workers, the iron in the present case, however, being not removed but localized as concretions. No buckshot was found in the clay horizons of Type B. This indicates that water incidence on this type, while sufficiently greater than on Type A to give temporary swamp conditions favourable to the development of the features just discussed, as well as darkening of the surface soil, is not sufficient to give any notable permeation of the clay-pan.

Type C, on the other hand, has been subjected apparently to much more severe swamp conditions, giving considerable permeation and leaching of the clay, at least in the earlier stages of swamp history. This has given rise to the definitely acidic clay horizons, very low in replaceable lime compared with corresponding horizons in the other types. Ashy streaks in the upper zones, grey or dark grey colour of the surface and strong yellow colour of subsoils reflect the conditions to which this soil is exposed. Buckshot is found to some extent right throughout the profiles of this type described in Table II. and III., a further indication of water penetration. On this account also the proportions of ferruginous pisoliths in the soil above the clay does not rise as high as in Type B. The profiles 3350 to 3355 and 3356 to 3360 of this type would appear to represent two different stages in the "degradation" of these soils by increased water supply. The second is practically depleted of lime to 66 inches and is notably low in soluble salts as compared with the first, which shows appreciable amounts of lime, both soft and rubble, below 37 inches. It is likely that the subsoils become progressively less permeable as this leaching of lime and salts continues, until even under prolonged swamp conditions there is very little permeation of the clay, leading to increased buckshot formation in the upper clay zones as shown in sample 3357 of the profile low in salts and lime.

The Position of These Soils Among the Great Group of Alkaline Soils.

On the basis of the discussion set out above, the soil types of this area may be classified tentatively among the solonized soils of the great world group of alkaline soils. None of the types may be called true solonetz, but mobility of clay under alkaline conditions, possibly under the influence of a degree of sodium saturation higher than that now found in these soils, offers the most reasonable explanation of their character and thus sets them in the class of solonized soils. The absence of carbonate from soluble salts and lack of full development of characteristic morphological features set them apart from the "classic" solonetz. Views on the specifications to which solonetz must conform are undergoing considerable change. Thus many morphological solonetz profiles have been described in recent years, particularly in the United States of America, which show no carbonate and very little replaceable sodium (3, 6, 9). Magnesium clay solonetz appears to have some definite standing as the result of recent work (3, 9).

With regard to morphological features in the soils described above, the structure of the "pan" horizon is naturally of first importance from the present point of view. Under field conditions the pans are very smooth and compact and do not crack to any degree unless very dry. Circumstances did not allow time for development of full cracking in the profiles photographed in the field (Fig. 3–5). Under suitable conditions, however, it is noted in the field that the upper portions of the clay-pans in Types A, B, D, and E, tend to columnar formation, while the lower portions usually show prismatic structure. Aggregates are rather large in both cases, breaking with difficulty to irregular pieces. Definitely rounded tops of the upper aggregates are unusual, but on the other

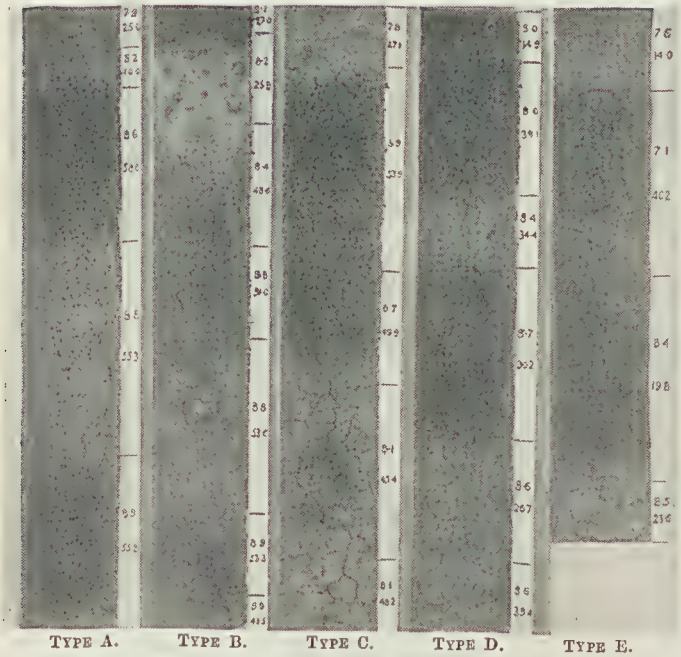


Fig. 6.—Model soil profiles of Types A to E. A depth of 6 feet is represented in each case except E, where 52 inches only are shown. The marks at the sides show points at which differentiation into horizons occurred. For each horizon reaction (pH) (lower figure) and clay percentage (upper figure) are shown. Note cracking in clay zones, bleaching and buckshot in Types B and C, light deep sub-soils and calcium carbonate nodules in Types D and E.

hand, there is a feature frequently observed which the writer considers equivalent, namely the presence of " floaters " of clay, up to about 2-in. diameter, surrounded by lighter material penetrating into the prism formation. This is characteristic of transition zones immediately above the clay-pan. Kellogg (7) has observed that transition zones are found often when the degree of sodium saturation in soils such as these is not specially marked.

In Type C profiles, some evidence of former similar character is shown, but the upper clay tends in general to very blocky structure with large aggregates. It is noted here that the reaction values for these C profiles suggest " reconstruction " to some extent in the sense indicated by Kellogg (7).

Review of the date concerning the soil types described leads to tentative classification of Types A, D, and E as solonized soils, B as a solotized or " degraded " solonetzic soil, while Type C may be regarded as a swampy variant of the latter class. The significance of buckshot has been mentioned. Its influence is such that Type B in particular might best be called a " pseudo solotized " soil, following the " pseudo-podsol " nomenclature of Brown et al (2).

The more striking features of these soils are illustrated by Fig. 6. which shows model profiles reproducing the horizons by adhesion of prepared samples of the actual soil to wooden strips by means of glue.

Representative Character of the Soils.

A point of considerable importance in assessing the value of a research station is the extent to which results of experiments carried out there may be applied to other areas. Obviously the question of soil types enters largely into the consideration.

While soils similar to Type B have not been described previously in Victoria, the other types occur very frequently throughout the Goulburn Valley and the North-Central areas of this State. This statement applies particularly to Types A, D, and E.

There is a considerable amount of data available concerning the soils of this region. The profile character of some Goulburn Valley soils has been recorded by Jewell (5) and an account of soil survey work at Bamawm, in the North-Central district, will be published shortly. Existing information makes it permissible tentatively to name Type A as Goulburn Valley Silty Loam, as it occurs widely throughout the Valley, particularly around Kyabram and Merrigum. The soil named Lockington Loam in the Bamawm work bears close resemblance to this type.

Type D represents the typical profile of the Tongala district and is closely related to " Ballendella Loam " of Bamawm, while Type E and its modifications are found frequently in the neighbourhood of Shepparton, and " Bamawm Sandy Loam " is a related soil. Type C occurs in " buckshot depressions " throughout the Valley: one such has been investigated at Merrigum and is closely similar to Type C as described above.

Difficulty has been experienced with some of these soils under irrigation in other districts. As an example, Bamawm Sandy Loam tends to waterlogging at Bamawm and the related Type E was found waterlogged on the holding at present under discussion at the north-east corner. From

the point of view of its representation of a considerable area of country, this allotment is therefore suitable for development as a research station.

It is proposed to discuss more fully the relations between Goulburn Valley and Bamawm soils and certain American types in a later report.

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Apple Leaf-hoppers.

(*Continued from page 330*)

the control while the addition of casein spreader reduced the kill still further.

General observations showed that where the oils were used, the proportion of adults which recovered from the effects of the spray was very high—actual counts showed a 70 per cent. recovery six hours after spraying. On the other hand this recovery did not occur where nicotine sulphate was used. This was emphasised by the marked prevalence of flying adults in the oil-sprayed trees and their scarcity in nicotine-sprayed trees.

The question of re-infestation of sprayed trees is an important one. The main source of re-infestation in spring and summer months is likely to be the eggs of the insect, which are embedded in the leaf tissues and are not likely to be affected by the nicotine sprays. The survival of these eggs would necessitate spraying at a later date to destroy the jassids emerging from them.

Re-infestation of sprayed trees by flying adults is not likely to be rapid, provided that all apple trees in an infested orchard are treated with a nicotine spray within a period of a few days, and no unsprayed, infested trees adjoin the sprayed ones.

Recommendations.

Since jassid infestation arises early in spring from overwintering eggs, it is essential, in the absence of any known method of destroying the winter eggs, to use contact sprays during the spring. A spray should be applied before any of the insects reach the adult egg-laying stage, and another would probably be required about three weeks later, to destroy jassids emerging at a late hatching. Such a spray should consist of nicotine sulphate 1 pint, hard or soft soap 2 pounds, and water 80 gallons; alternatively 1 pint of nicotine sulphate and 1 gallon of white oil per 80 gallons of water could be used alone or included in the codling moth spray program.

During any season in which jassids are prevalent in apple orchards, it would be advisable to include nicotine sulphate in all codling moth sprays. In controlling jassids it is essential that the spray should reach the *under* sides of the leaves if the best results are to be achieved.

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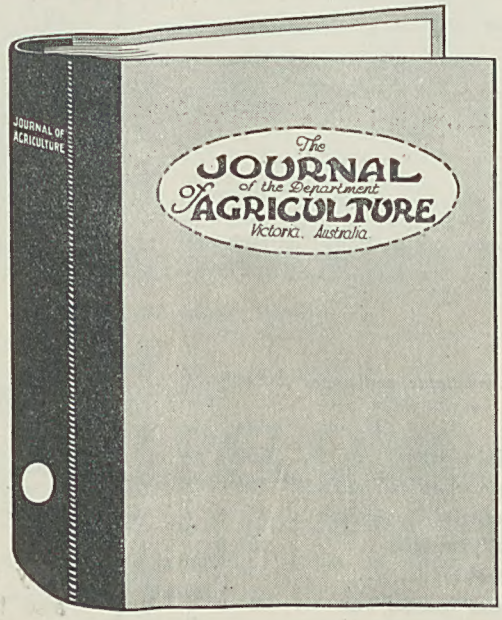

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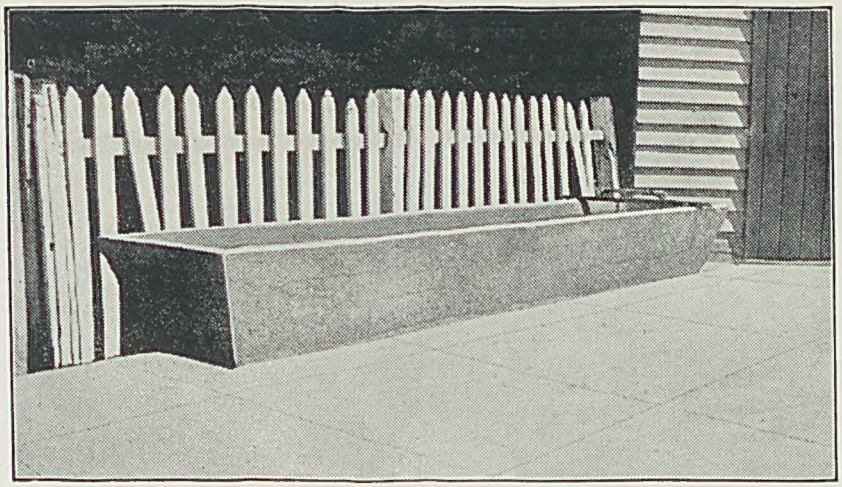

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